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THE
SURGICAL CLINICS
OF
CHICAGO

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CONTENTS OF VOLUME 1

Clinic of Dr. E. Wyllys Andrews, *Mercy Hospital*

PAGE
Fracture of the Patella Treated by Open Operation ... 83
Three Cases of Plastic Surgery ... 89
Case I.—Operation for Large Web Binding Arm to Thorax ... 89
Cases II and III.—Flap Methods and Abdominal Skin Pockets versus Thiersch Grafts after Hand Injuries ... 92
Divided Blood-vessels as Aids to Accurate Wound Closure ... 317
Varicocele: New, Old, and Combined Methods of Operative Relief ... 505
Hemangioma of Brain Inoperable by Ordinary Methods, Treated by Boiling Water Injections and Hot Metal Point ... 965

Clinic of Dr. Carl Beck, *North Chicago Hospital*

Open Wound Treatment of Acute and Chronic Bone and Joint Infections: Clinical Talk, with Demonstrations of Three Cases ... 135
New Treatment of Large Cavities after Empyema of the Chest: Demonstration of a Case and Clinical Talk ... 145
Plastic Operations on the Upper Extremity ... 345
Treatment of Obstinate Sciatica ... 511
Pendulous Abdomen: Cure by Removal of Excess Fat and Obliteration of Ventral Hernias ... 731
Transperitoneal Approach to the Kidney ... 737
Diastasis of the External Oblique Simulating a Direct Hernia of the Abdomen and Its Cure ... 743
Tendo- and Neuroplasty ... 985
Elephantiasis and Its Treatment by the Handley Operation ... 993
Temporary Enterostomy ... 1267

Clinic of Dr. Frederic A. Besley, *Cook County Hospital*

Regional Surgery: Diseases of the Chest Wall Including the Pleura and Breast ... 659
Fractures ... 1273

Clinic of Dr. A. D. Bevan, *Presbyterian Hospital*

Gall-stone Disease ... 1
General Principles of the Operative Cure of Inguinal, Femoral, and Diaphragmatic Hernias. Demonstration of Three Cases ... 21
Surgical Lesions of the Colon ... 287
Pulsion Diverticulum of the Esophagus—Cure by the Sippy-Bevan Operation ... 449
Removal of Murphy Button from Stomach Two and One-half Years After Gastro-enterostomy for Duodenal Ulcer ... 459
Hernia of the Diaphragm ... 463
Carcinoma of the Jejunum; 5 Cases of Chronic Intestinal Obstruction Due to Lesions Located Near the Duodenojejunal Junction ... 471
The Technic of Colostomy ... 693
Prolapse of Rectum: Technic of Rehn-De Lorme Operation Under Local Anesthesia 699
Benign Tumors of the Breast, Chronic Inflammations, and Carcinoma ... 889
Carcinoma of the Breast ... 901
Carcinoma of Rectum—Treatment by Local Excision ... 1233
X-ray Burn of Anal Region ... 1240
Suprapubic Prostatectomy ... 1245

Clinic of Dr. French S. Cary, *College of Medicine, University of Illinois*

Stubborn Cystitis ... 1261

Clinic of Dr. James T. Case, *St. Luke's Hospital*

Comparison of the Operative and Radiotherapeutic Treatment of Uterine Myomas ... 579

Clinic of Dr. Carey Culbertson, *Presbyterian Hospital*

Therapeutic Abortion and Sterilization ... 605

Clinic of Dr. Arthur H. Curtis, *St. Luke's Hospital*

Remarks on Salpingitis ... 621
Remarks on Leukorrhea ... 777

Clinic of Dr. Vernon C. David, *Presbyterian Hospital*

Local Anesthesia for Hemorrhoidectomy ... 543

Clinics of Dr. Carl B. Davis, *Rush Medical College and Presbyterian Hospital*

Suppurative Pericarditis—Demonstration of a Case One Year After Operation ... 375
A Case of Pancreatic Abscess, Result One Year After Operation ... 561
Cancer of the Rectum ... 1221

PAGE

Clinic of Dr. C. Henry Davis, *Presbyterian Hospital*

Clinical Talk on Anesthesia in Gynecology and Obstetrics 1253

Clinic of Dr. George G. Davis, *Presbyterian Hospital*

Cure for Hallux Valgus: The Interdigital Incision 651

Clinic of Dr. Frederick G. Dyas, *Cook County Hospital*

Open Treatment of Infected Wounds 441
Treatment of Carcinoma of Tongue with Radium 1301
Old Fracture of Patella 1305

Clinics of Dr. D. N. Eisendrath, *Cook County and Michael Reese Hospitals*

Head Injuries—Two Cases Complicated by Symptoms of Intracranial Involvement .. 169
Carcinomatous Ulcer on Posterior Wall of Stomach with Perforation Into Lesser Peritoneal Cavity; with a Talk on the Rehfuss Fractional Aspiration Method by Dr. Walter W. Hamburger 177
Inguinosuperficial Hernia Associated with Non-descent of the Testis 367
Gunshot Wounds of the Skull 515
The Diagnosis and Treatment of Common Duct Calculi—with Special Reference to Overlooked Common Duct Calculi 747
The Complications of Appendicitis 1035
Two Cases Illustrating the Clinical Importance of Congenital Anomalies of the Kidney 1053
Gunshot Wounds of Femur 1306

Clinic of Dr. J. S. Eisenstaedt, *Michael Reese Hospital*

Mechanical Aids in the Diagnosis of Lesions of the Upper Urinary Tract 799

Clinic of Dr. Louis A. Greensfelder, *Michael Reese Hospital*

Demonstration and Reduction of an Old Subcoracoid Dislocation of the Shoulder (by Dr. David C. Straus) 391

Clinic of Dr. Albert E. Halstead, *St. Luke's Hospital*

Three Cases Illustrating Points in the Surgical Pathology of the Region of the Embryonic Branchial Clefts 323
  Case I.—Ranula 323
  Case II.—Cyst of the Ductus Thyroglossus 329
  Case III.—Retromaxillary Tumor Probably of Branchial Origin 334
Internal Hydrocephalus: Puncture of the Corpus Callosum 489
Pyloric Obstruction Following Sulphuric Acid Poisoning 495
Hereditary Deformans Chondral Dysplasia 951

Clinics of Dr. Malcolm L. Harris, *Alexian Brothers and Henrotin Memorial Hospitals*

Laryngectomy Under Nerve Blocking 339
Hernia of the Breast 959

Clinic of Dr. N. Sproat Heaney, *Presbyterian Hospital*

V-Shaped Hysterectomy for Dysmenorrhea and Leukorrhea 627

Clinic of Dr. Allen B. Kanavel, *Wesley Hospital*

Transplantation of Fascia Lata in Exstrophy of the Bladder, Complete Defects in the Abdominal Wall, and Spina Bifida 153
  Case I.—Exstrophy of Bladder with Double Inguinal Hernia 155
  Case II.—Complete Defect of the Abdominal Wall 163
  Case III.—Spina Bifida 165
Bullet Located Between the Atlas and the Base of the Skull: Technic of Removal through the Mouth 361

Clinic of Dr. Gustav Kolischer and Dr. J. S. Eisenstaedt, *Michael Reese Hospital*

A New Method of Anesthesia in Prostatectomy 805

Clinics of Dr. Herman L. Kretschmer, *Presbyterian and Alexian Brothers Hospitals*

(With Presentation of Two Cases from Alexian Brothers Hospital)

Benign Hypertrophy of the Prostate and Its Treatment by Suprapubic Prostatectomy 811
Hydronephrosis Due to Kidney Stone: Remarks on the Diagnosis and Treatment of Renal Calculus 999
Ureteral Calculus: Removal by Intra-ureteral Injections of Oil 1011
Tuberculosis of the Kidney—Presentation of Three Cases 1139

Clinic of Dr. Philip H. Kreuscher, *Mercy Hospital*

Semilunar Cartilage: Fracture-dislocation and Fragmentation 787
Hypertrophic Villous Synovitis of the Knee-joint 1291

Clinic of Dr. Dean Lewis, *Presbyterian Hospital*

PAGE
Neurolysis and Nerve Suture 103
Bleeding Nipple with Plastic Operation Upon the Breast 117
Congenital Pyloric Stenosis 125
Separation of the Lower Epiphysis of the Femur with Anterior Displacement and T-Fractures 1105
Myositis Ossificans Developing in a Clean Incised Abdominal Wound 1119
Blastomycosis and Sporotrichosis 1125

Contribution by Dr. L. L. McArthur

An Improvement in the Technic of Gastric Surgery 97

Clinic of Dr. L. L. McArthur, *Michael Reese Hospital*

Thrombo-angiitis Obliterans of Buerger: Modified Koga Treatment 499

Clinic of Dr. Hugh McKenna, *St. Joseph's Hospital*

Demonstration of Cases Illustrating Important Aspects of the Indications, the Technic, and the Results of Bone Transplantation and Arthroplasty 415
  Case I.—Double Hallux Valgus 417
  Case II.—Fracture of the Femur Treated by Means of an Autotransplant 419
  Case III.—Tuberculosis of the First Phalanx of the Second Finger 423

Demonstration of Previously Operated Cases

  Case I.—Tuberculosis of the First Phalanx of Middle Finger 425
  Case II.—Arthroplasty for Ankylosis of Elbow 426
  Case III.—Double Dislocation of the Shoulder 429
  Case IV.—Fracture of the Humerus: Bone Transplant 433
  Case V.—Congenital Absence of Scaphoid: Repair by Bone Transplantation 436
A Case of Perforated Duodenal Ulcer 1063
Early Recognition and Treatment of Acute Appendicitis 1069

Clinic of Dr. Harry E. Mock, *St. Luke's Hospital*

A Case of Bichlorid of Mercury Poisoning Diagnosed as, and Operated on for, Perforated Gastric Ulcer 1077

Clinic of Dr. A. J. Ochsner, *Augustana Hospital*

Goiter (The Indications for and the Technic of the Surgical Treatment of Goiter, Illustrated by Three Cases) 47
A Case of Femoral Hernia 65
Hernias in Children (Clinical Talk with Demonstration of the Operative Treatment of an Inguinal Hernia in the Case of a Child Eleven Months of Age) 71
Carcinoma of the Breast: Diagnosis, Indications for Operation, and Technic of the Radical Cure 223
Intra-abdominal Strangulated Inguinal Hernia 239
Vaginal Hysterectomy for Carcinoma of the Cervix Uteri: Radiotherapy in the After-treatment as Applied by Dr. Henry Schmitz 479
Craniotomy for Jacksonian Epilepsy 681
Tumor in Undescended Testicle 689
Talipes Equinovarus Following Acute Anterior Poliomyelitis: Treatment by Lengthening the Tendo Achillis and Overcorrection in a Plaster Cast 913
Varicose Veins of the Leg 917
Postoperative Tetany of Sternocleidomastoid Muscle: Treatment by Tenotomy and Calcium Lactate Internally 931
Actinomycosis of the Colon; Ileosigmoidostomy; Treatment of Actinomycosis 1203
Carcinoma of the Rectum—Excision—Transplantation of Sigmoid Into Perineum—Technic of Operation 1213

Clinic of Dr. Paul Oliver, *Cook County Hospital*

Epithelioma of the Cheek 867
Acute Retention of Urine Due to Urethral Calculus 871
Carcinoma of the Stomach 873
Bilateral Renal Calculi 879
Tetanus Following a Burn: Intraventricular Injection of Antitoxin 885

Clinics of Dr. Charles A. Parker, *Cook County Hospital and Home for Destitute Crippled Children*

The Treatment of Burns with Special Reference to the Prevention of Deformities 635
Acute Suppurative Destruction of the Upper Femoral Epiphysis—So-called Epiphysitis 851

Clinic of Dr. N. M. Percy, *Augustana Hospital*

Pernicious Anemia; Splenectomy; Blood Transfusion 251
Resection of Stomach for Carcinoma 565
Partial Evisceration Through Vagina During Attempted Abortion 979

Clinic of Dr. D. B. Phemister, *Presbyterian Hospital*

Echinococcus Cyst of the Liver Complicated Later by Subphrenic Pyopneumothorax and Hydropneumothorax 203
Central Fibroma of Mandible 215
Chronic Lung Abscess with Pulmonary Hypertrophic Osteo-arthropathy 381
Reconstruction of the Hepatic Duct 553
Brain Cyst Following Skull Fracture 971

PAGE

Clinic of Dr. Samuel C. Plummer, *St. Luke's Hospital*
A Case of Calculous Anuria........ 191

Clinic of Dr. John Lincoln Porter, *St. Luke's Hospital*
Calcaneocavus: Tendon Transplantation........ 535

Clinics of Dr. John Ridlon, *Presbyterian and Mercy Hospitals*
Congenital Dislocation of the Hip........ 271
Hip Disease........ 935

Clinic of Dr. Edwin W. Ryerson, *Chicago Policlinic Hospital*
Ankylosis of Elbow........ 197
Tendon Transplantation for Relief of Paralysis Following Anterior Poliomyelitis 721

Clinic of Dr. Louis E. Schmidt, *Alexian Brothers Hospital*
A Demonstration and Discussion of the Technic of Prostatectomy........ 1169

Clinic of Dr. George E. Shambaugh, *Presbyterian Hospital*
Case I.—Carcinoma of the Maxillary Sinus........ 831
Case II.—Chronic Empyema of the Nasal Accessory Sinuses........ 835
Case III.—Suppurative Otitis Media with Paralysis of the External Rectus........ 841
Case IV.—Chronic Infection of the Submaxillary Gland........ 845
Case V.—Chronic Empyema of the Maxillary Sinus........ 847
Case VI.—Ludwig's Angina........ 849

Clinic of Dr. Kellogg Speed, *Cook County Hospital*
Tendoplasty for Wrist-drop; Description of a New Operation........ 187
Mediastinal Tumor Probably Originating in the Thymus Gland: Associated Thyroid Enlargement........ 643
Demonstration of Cases Before the Chicago Surgical Society, May 4, 1917........ 703
  Case I.—Carcinoma of the Lower Lip........ 703
  Case II.—Decompression for the Relief of Traumatic Epilepsy........ 707
  Case III.—Decompression for Hypophyseal Tumor........ 711
  Case IV.—Occipital Decompression for Increased Intracranial Tension........ 715
  Case V.—Perforated Gastric Ulcer........ 717
Hematuria in Appendicitis........ 1097
Right Upper Quadrant Appendicitis........ 1319

Clinic of Dr. David C. Straus, *Michael Reese Hospital*
Strangulated Appendix in a Femoral Hernia; Appendectomy Through Femoral Incision........ 769
Hammer-toe........ 1081
Hammer-toe—Modified Jones' Operation with Details of the Technic........ 1091

Clinic of Dr. Thomas J. Watkins, *St. Luke's Hospital*
Perineorrhaphy........ 595
Cystocele, Uterine Prolapse, Retroflexion, and Rectocele Repaired by Plastic Operation Upon Broad Ligaments and Vagina; Fixation of the Round Ligaments and Advancement of the Anterior Vaginal Wall; Perineorrhaphy........ 1021
Radium in Hemorrhage at the Menopause........ 1031

INDEX TO VOLUME I........ 1327

SURGICAL CLINICS OF CHICAGO

Volume 1 Number 1

CLINIC OF DR. A. D. BEVAN

PRESBYTERIAN HOSPITAL

GALL-STONE DISEASE

Summary: Diagnosis and treatment of gall-stone disease as practised in 1860; development of operative treatment; cholecystotomy, cholecystectomy, cholecystenterostomy, choledochotomy, transduodenal choledochotomy; experience of Musser and Keen; etiology of gall-stones—"stone-bearing catarrh"; incidence of gall-stones; why gall-stones cause pain—movement of the stone due to peristaltic action of minor importance; symptoms of gall-stones may be purely mechanical, but usually mean the lighting up of a bile-tract infection; spontaneous passage of large gall-stones due to pathologic cholecystenterostomy; history and physical examination of a patient with acute suppurative cholecystitis; operation following subsidence of acute symptoms; technic of cholecystectomy in the presence of massive adhesions; postoperative treatment; postoperative complications; the medical treatment of gall-stones; the diagnosis of gall-stone disease; cholemia—its importance in relation to the operative risk; pancreatitis and gall-stone disease; gall-stones and cancer; gall-stone ileus; surgical therapy for all gall-stone cases which are good surgical risks; summary of the indications affecting the choice of the operation; cholecystectomy in 90 per cent. of the cases; necessity of a wide exposure of the operative field in order that thorough work may be done.

November 6, 1916.

I WANT to take up this morning an important part of abdominal surgery, namely, gall-stone disease. I will give you the essential facts in the etiology and diagnosis of gall-stone disease. I want to say a word or two in reference to the history as we find it today, and I shall operate upon a patient in whose case the clinical diagnosis of gall-stone disease has been made.

Of course, gall-stone disease has been known for centuries; I am not going to ask you to go back and review the ancient literature of the subject. I would, however, like to refer you to some lectures that will give you a pretty full idea of what was known of this subject in 1860. Those are the lectures of Trousseau on gall-stones in his "Clinical Lectures" which are published by the Sydenham Society, which you will find in most medical libraries. Up to the time of Trousseau practically nothing was known in regard to gall-stone surgery. It was known that cholelithiasis was not infrequently encountered, but the medical men of that day did not attempt to make a definite diagnosis of gall-stone disease unless in the history of the case the patient had passed gall-stones per rectum. Even where the clinical picture to us would seem perfectly clear—*i. e.*, repeated attacks of gall-stone colic and even jaundice—the clinicians of that time did not attempt to make an absolute diagnosis unless the gall-stones were recovered in the feces. Of course, we know that this is not very often done, that we have dozens of gall-stone cases that do not pass gall-stones into the bowel to one where this occurs. Not only that, but we know now that gall-stones are sometimes disintegrated in their passage through the bowel, and that even when gall-stones are extruded from the bile-tract a certain percentage are never recovered in the feces, but are disintegrated in their passage through the intestinal tract. This has been proved by having a man swallow gall-stones that have been removed from another case, and then watching the case carefully and finding we could not always recover the stones, that they had disintegrated in their passage through the alimentary canal. How often this happens we do not know, but we do know that it occurs. At the time of Trousseau, though this very limited amount of knowledge which I have roughly sketched to you was known in regard to gall-stones, practically nothing was done in the way of operative treatment. These patients were never operated upon unless an abscess developed at the site of the gall-bladder and pointed toward the skin, and was then incised. Of course, the clinicians of those days handled a number of cases where this occurred. Opening the abscess through the skin would permit the bile and gall-stones to pour out. When I gave this course last year I had an opportunity of showing one of these cases.

A man came into the clinic with a history of repeated attacks of gall-stone disease, and with a history of an abscess in the right upper quadrant of the abdomen almost ready to break through the skin. Under gas we made an incision through the skin and out poured a lot of pus, bile, and gall-stones. He made a recovery from the profound septic condition in which he was when he came to the clinic and refused to have the radical operation done. The wound eventually healed and remained healed for a short time, and then he had a recurrence of the symptoms, but not nearly of such an intense degree, and after some pain and evidence of sepsis the fistulous tract opened up again and out

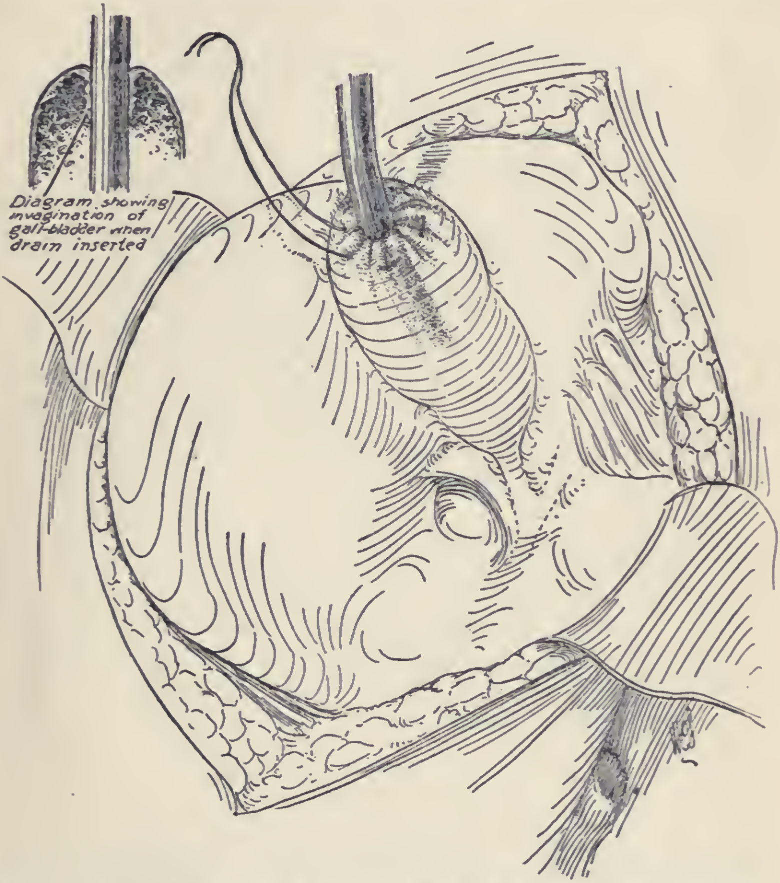
Diagram showing invagination of gall-bladder when drain inserted

Fig. 1.—Cholecystotomy. Note invagination of gall-bladder about rubber drainage-tube by two purse-string sutures of catgut.

poured some more pus, bile, and a few gall-stones. After he had this second attack he consented to allow me to operate. I did a radical operation, a cholecystectomy, a removal of the gall-bladder and the cystic duct, both of which contained gall-stones, and the man went on to a permanent recovery. That you might describe as one of the old-fashioned cases of neglected gall-stone disease, as such cases necessarily were neglected in the time of Trousseau.

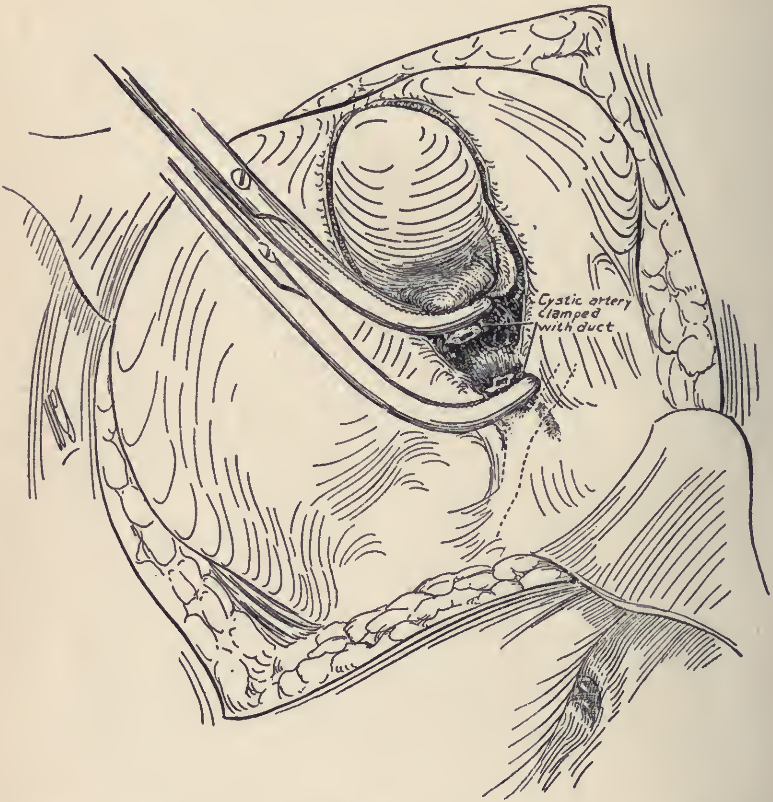

Fig. 2.—Cholecystectomy. Dissection from below. The cystic duct and artery are grasped by two full-curved clamps. After cutting between the clamps the gall-bladder may be shelled out quite readily with a minimum of hemorrhage since the cystic artery is under control from the beginning.

The first operation that we find recorded definitely for gall-stones was performed by Bobbs in Indianapolis in 1867. That was the same year in which Lister made the first report on antiseptic treatment. Then, in 1878, Marion Sims and Lawson Tait began to do the rather simple operation of *cholecystotomy*, an incision into the gall-bladder, removal of the stones, and drainage of the gall-bladder (Fig. 1). This was the first operation that was done, and, of course, in quite a proportion of the cases it was successful. In about 1882 Langenbuch removed the gall-bladder for the first time—the operation of *cholecystectomy* (Figs. 2 and 3).

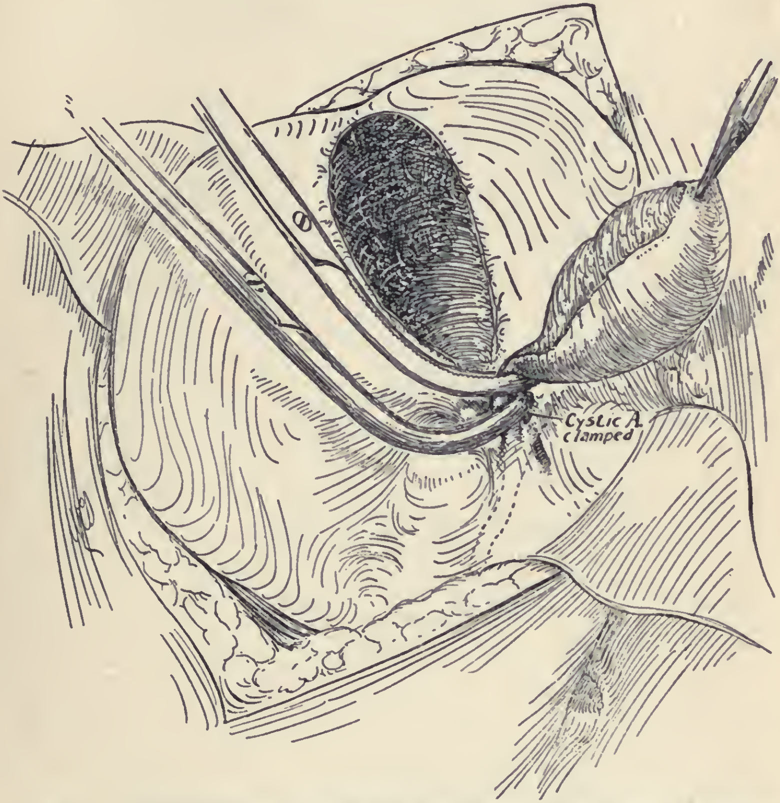

Fig. 3.—Cholecystectomy. Dissection from above. This method frequently becomes a necessity when the direct approach to the cystic duct and artery, as shown in Fig. 2, is obstructed and the clamps cannot be applied until the gall-bladder has been freed.

A few years later Winiwarter introduced the operation of *cholecystenterostomy* (Fig. 4). A cholecystenterostomy is the establishment of anastomosis between the gall-bladder and the intestine.

In 1885 Charles T. Parkes, who was then professor of surgery in this clinic, suggested the operation of *choledochotomy*, a direct incision into the choledochus or common duct for the removal of gall-stones floating or impacted there (Fig. 5). Fenger, in a classical article in the "American Journal of the Medical Sciences" some years later, in discussing ball-valve action of stone in the common duct, gave Parkes credit for first suggesting choledochotomy. Unfortunately, Parkes' article was published in a local medical journal with limited circulation and did not

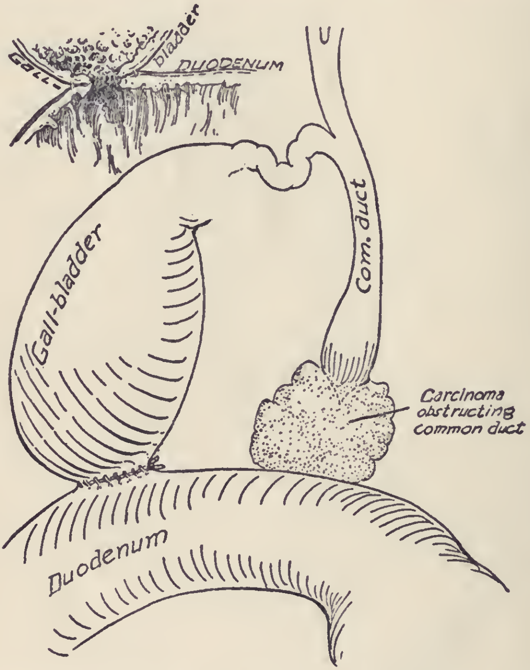

Fig. 4.—Cholecystenterostomy. Indicated in the presence of permanent obstruction of the common duct. The insert shows a section through the anastomosis and the two layers of sutures which maintain it—an inner hemostatic stitch including all the tissue layers and an outer Lembert.

receive much attention. Parkes did not have the opportunity in the few years he lived after this time—he died in 1889—of doing a choledochotomy. Then a few years later the final operation of importance that has been developed in connection with the bile tracts was introduced by Charles McBurney, the New York surgeon who did so much to develop the surgery of appendicitis. That operation, known as *transduodenal choledochotomy*, is for the removal of stones impacted in the ampulla. McBurney's method was to make a direct incision in the duodenum and remove the stone from the inside of the duodenum. He then closed the small incision that had been made in the duodenum.

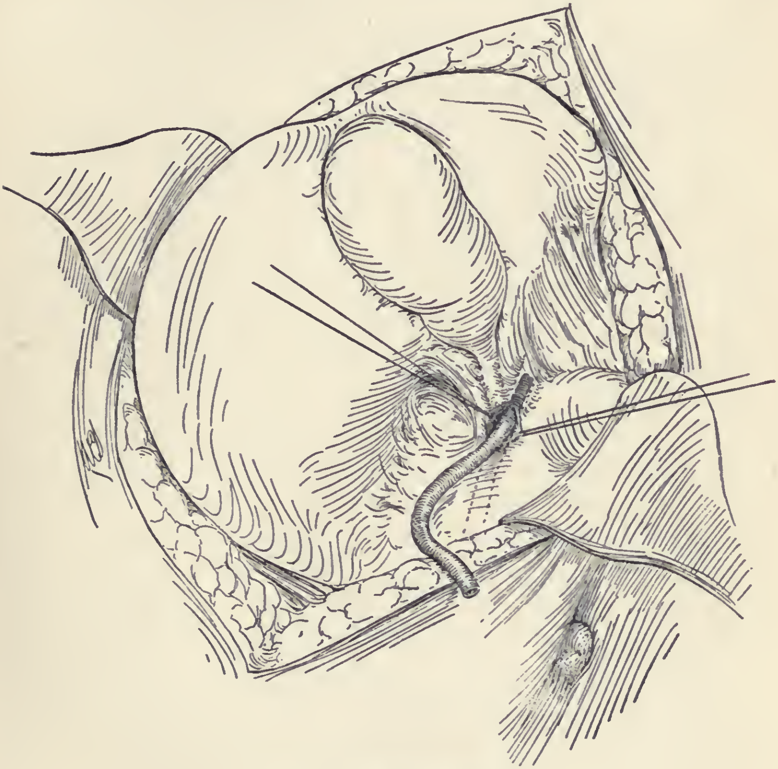

Fig. 5.—Choledochotomy.

These are the steps that mark the progress of the surgery of gall-stone disease. To show how recent this work is, let me refer to the fact that in the "American Journal of the Medical Sciences" in 1884 John Musser and W. W. Keen, of Philadelphia, have the first extensive article on the subject of gall-stone surgery that was published in this country. They report 3 cases done by Keen. Musser was the internist and Keen was the surgeon. They also tabulated all the gall-stone cases that had been done up to that time as far as they could obtain the literature. They could collect only 85 cases. Keen in some of his cases opened the peritoneal cavity in what seemed to be perfectly clear pictures of gall-stone disease, and found extensive adhesions around the gall-bladder, burying the gall-bladder in adhesions between the omentum and transverse colon, the stomach, and the liver. In such cases he would retreat, with the statement that he did not think it was justifiable to go ahead and separate those adhesions. One of the most illuminating statements in this article is the last sentence, which is as follows: "The authors are very much gratified to find, after reviewing these 85 cases, the mortality in this series of cases was so low; only 30 per cent. of the patients died." Now, to our modern surgeon that is most interesting because the mortality has been reduced to 1 or 2 per cent. in ordinary gall-stone cases where the stones are in the gall-bladder and cystic duct; somewhere near 5 per cent. where the gall-stones are in the common duct.

Now a word in regard to the etiology of gall-stones: Gall-stones are the result of a mycotic infection of the mucous membrane of the bile tracts. As a rule, they are formed in the gall-bladder, but sometimes in other parts of the biliary tract. It is a mycotic infection of the mucous membrane, what the old-time surgeons used to call a "stone-bearing catarrh" when they were discussing the subject of the formation of stones in the kidney or the urinary bladder. It was recognized for years that the most important factor in the development of stones in the bladder or in the kidney was a catarrhal condition of the mucous membrane, leading first to the formation of nuclei of masses of bacteria or mucus around which the salts of the urine, in the case of the kidney or bladder, might crystallize and form calculi. The same thing happens in the gall-bladder. The mycotic infection of the mucous membrane of the gall-bladder results first in the development of a mass of bacteria or blood or mucus around which there is deposited cholesterin. In the formative stage these masses of cholesterin are soft, like putty. We have had occasion in our operations to see gall-stones in their formative stage, when you could pick them out and squeeze them out of shape just as you can putty. Usually there is deposited around this mass bilirubin-calcium and biliverdin-calcium and carbonated calcium forming a sort of shell. This process may be repeated, so that in some gall-stones when you split them open you find a number of layers like an onion—a nucleus, and around that a mass of carbonated calcium, bilirubin- or biliverdin-calcium, and around that another layer of cholesterin, and then still another layer of carbonated calcium or bilirubin- or biliverdin-calcium, and so on.

A word in regard to the cause of mycotic infections: The main cause is probably the colon bacillus. The typhoid bacillus is also a common cause. Pus organisms of a comparatively low degree of virulence, as the staphylococcus and streptococcus, may be the cause of the mycotic infection. Gall-stones are not produced by virulent infections of the gall-bladder. The infection must be of a low type and not one that produces pus, but one in which we find simply a catarrhal inflammation. That we may have aseptic gall-stones I have little doubt. I think that there is evidence to show that the course of events necessary to lead up to gall-stone formation may be purely chemical and not mycotic, but the clinical picture is usually that of a mycotic infection.

In regard to the number of gall-stones, they may be single or multiple. When they are single in the gall-bladder they are usually oval and round. When they are multiple, they are usually faceted. Are these facets polished off? No, they are made exactly like the honeycomb of the bee. If the bee made a single honeycomb, it would be round on transverse section. If he makes forty, they are crowded together, and you get the faceted picture that you find in the honeycomb. The same thing is true of gall-stones. If you have forty pieces of soft putty-like cholesterin in the gall-bladder under pressure, these forty soft masses are pressed together and produce these facets. Then each one of these facets is usually covered with carbonate of calcium or other calcium salts in the bile and give you the faceted picture that is so common where we have multiple gall-stones. Stones in the cystic duct and in the common duct are often faceted. Why? Because they are stones that have been forced from the gall-bladder into the cystic duct and into the common duct. Where a stone is formed in the cystic duct or where it is formed in the common duct, it is either round or oval. Not infrequently where we have several gall-stones formed in the cystic duct we have the picture of barrel-shaped stones in the cystic duct, rather definite and rather easily recognized. So much for the etiology.

What about the natural history of gall-stone disease? What are the factors that lead to this mycotic infection of the gall-bladder and biliary tracts generally? Primarily a stagnation of the bile, more frequent in women than in men, because of the greater activity on the part of men, and because of the tighter clothing in women and because of the incident of pregnancy in women. Gall-stone disease is about five times as common in women as in men. In regard to the age, gall-stones are rare in early life. We occasionally find a patient under ten, but we have had very few out of the large series of gall-stone cases which we have observed. We have few under twenty; comparatively few. More common after pregnancy; not very frequent from twenty to thirty, more frequent from thirty to sixty in women. In talking about the natural history we find this interesting fact, that in postmortem statistics and in the statistics we used to obtain from our cadavers when I was an anatomist, probably 10 per cent. or more of the people over fifty have gall-stones. In a large proportion of these, the ages of which it is difficult to state, there was no evidence of the existence of gall-stone disease in the case during life. The patient had had no symptoms. In other words, gall-stones may remain latent for years or permanently in an individual without producing any symptoms of their presence. I am satisfied that this is not at all an uncommon thing. But if they do produce symptoms, how are the symptoms produced?

In two ways, first, in a purely mechanical way in the effort of the biliary tract to expel the stones, as in the effort of the gall-bladder to push gall-stones out through the cystic duct. But what is much more important is the occurrence of repeated infections of the bile tract; the presence of gall-stones lighting up an acute coryza of the bile tract, if you please, just as we have a cold in the head. These acute infections result in the development of great quantities of mucus and in a swelling of the mucous membrane, and if we have in that case a stone in the cystic duct, this prevents the outflow of bile or the entrance of the bile and the outflow of mucus. Now what happens? The gall-bladder mucosa continues to secrete, and under the stimulation of the acute infection with the accumulation of the mucus you have what? An increase of the intracystic tension. The gall-bladder is distended by this accumulated mucus and that produces the pain. Pain in gall-bladder disease is due to the intracystic tension. It is not due to peristaltic action alone. How do we know that? Take a case of stone with intense colic and the stone impacted in the cystic duct. Under local anesthesia open the gall-bladder, put in a rubber tube: the tension of the gall-bladder is relieved and the pain ceases. Another group of cases illustrates that beautifully—the patient is operated on for gall-stones and, unfortunately, one is left in the cystic duct. The patient makes a good recovery, the external wound heals up within a short time. Then the patient has an attack of colic, and within a few days that old fistula opens up and out pours some mucus and possibly a little pus, and the pain is gone the minute the opening is re-established and the intracystic tension relieved. Now we have watched this with kidney-stone cases with a great deal of interest. Take a case, for instance, where we have a stone impacted in the ureter with intense colic, sometimes anuria, sometimes complete anuria with stone in both ureters, or sometimes when the stone is in a single ureter, there develops a complete anuria, mechanical on one side and reflex on the other; the patient passes no urine whatever. Now under those conditions I have not infrequently had to do a nephrotomy. Under gas anesthesia I open the pelvis and introduce a tube.

The pain disappears at once. The *x*-ray picture shows the kidney stones impacted in the upper end of the ureter 2 inches or so from the pelvis. Three days later another *x*-ray picture is taken and the stone is found to be halfway down to the bladder. A few days later it passes down to the bladder and is passed per urethra. Now, in all the period in which that stone travels through the ureter, as long as you have a tube in the pelvis of the kidney you have no pain whatever. In other words, this condition of pain is due to the tension in the kidney, to the intrarenal tension, and in the bile tract to the intracystic tension if it is limited to the gall-bladder, or if it involves the common duct to the tension that is put on the common duct, and, of course, on the intrahepatic ducts as well. It is very much easier to produce this complete obstruction with a swollen mucous membrane and with a stone in the cystic duct or the common duct than with a mucous membrane that is approximately normal. That is especially true where the stone is in the common duct. When the mucous membrane of the common duct is not swollen the stone moves freely up and down like a ball-valve. Then, when the mucous membrane is swollen from a lighting up of an inflammatory condition, you have obstruction with pain and jaundice. I would like very much to have this matter perfectly clear in your minds, that the symptoms in gall-bladder disease may be perfectly mechanical, but usually mean the lighting up of an inflammation in the bile tract.

If you will examine the cystic duct carefully you will find an arrangement of the mucous membrane, the valve of Heister, in an S-shaped curve that makes it almost impossible to pass a small probe through, and a very small stone cannot pass through the normal cystic duct. As the result of a gradual dilatation of this cystic duct small gall-stones can pass through, and then larger ones, until finally fair-sized gall-stones can pass through a dilated cystic duct; but that is not the usual way of getting rid of gall-stones, especially in those cases where the patients come to you with a handful of gall-stones which they have passed after some serious attack. That happens because a spontaneous pathologic cholecystenterostomy has developed. Now what do I mean by that?

The gall-bladder becomes adherent to the duodenum, and the pressure-necrosis produces a perforation between the gall-bladder and the duodenum, and the stones pass into the small bowel, or they may escape into the transverse colon or into the stomach.

Now I will digress for a short time and go on with the operative side of this case.

HISTORY

The patient, a married woman of thirty-two years, was admitted to the hospital complaining of pain in the right upper quadrant of the abdomen, nausea, vomiting, chills, fever, headaches, and shortness of breath.

She had her first attack ten years ago while in Europe. Previous to this the patient felt perfectly well. The pain, which was sharp in character, localized in the right upper quadrant and never radiated to the back or right scapula. The pain was present constantly for four months, during which time she was in bed. It was only relieved by morphin hypodermically twice a day. She was nauseated and vomited daily. No blood was present in the vomitus, but it was yellowish in color. Chills and fever were also present. After four months the symptoms disappeared until four days ago.

Four days ago the attack came on at 5 A. M. while the patient was in bed. It was associated with nausea and vomiting. There was no blood in the vomitus at this time. The pain was located in the subcostal region and never radiated to the back. There was less pain when she lay upon the abdomen. Morphin was given for relief. The patient has eaten nothing for four days for fear of increasing the pain. Headache began yesterday and has persisted up to the present time. She also complains of shortness of breath.

Past and menstrual histories are negative. She was married at seventeen. Her husband is living and well. Five children are living and well. She has never had typhoid. She was jaundiced for four months with the first attack.

Her temperature on admission was 101.8° F. and then went to 102° F. The next day it went down to 99.8° F. The third day it went up to 101.2° F., and has been going up around 100° F.

every evening. The leukocyte count is normal, around 8000. Urine is negative. There is distinct rigidity and tenderness over the gall-bladder.

You note that her first attack was after her marriage and after her pregnancy. Pregnancy is an important element in gall-stone disease. The acute symptoms are gone. It is wise to wait until the acute symptoms are over before operating on these cases.

OPERATION

Now I want to call your attention to the incision that has been made here. It is the **S**-shaped incision that has been developed in this clinic (Fig. 6). It begins at the ensiform cartilage and curves down a little until it gets to the middle of the rectus, and then is carried down over the middle of the rectus for 4 to 6 inches, where it curves outward like an old-fashioned letter **S**.

We divide the skin and the superficial fascia. Now I come down to the anterior sheath of the rectus. I am dividing this over about the middle of the rectus, parallel, of course, with the rectus fibers. I come down to just above the umbilicus and shoot a little bit out, following the curve of the **S**. Now I take a blunt dissector, like a Kocher, and split the rectus. I am not cutting the rectus, I am splitting the rectus. Doing this I get some little bleeding from the muscle branches in the rectus muscle. That exposes the posterior sheath of the rectus. The posterior sheath of the rectus is composed of the transversalis and half of the internal oblique. I divide this posterior sheath and divide at the same time the peritoneum, trying not to injure any of the important structures beneath. This is almost the same length as my original incision.

Now I find that this is the sort of a case that even the great surgeons, when Keen and Musser made their report, would have retreated from, because in those early days they did not attempt to get out a gall-bladder from such a mass of adhesions. I find this gall-bladder covered by this mass of omentum. The gall-bladder is distinctly enlarged. The next step that will be necessary will be the separation of these adhesions from the gall-bladder so that we can bring it into view. I think we are going to have a good deal of trouble separating them because they are so firm and so vascular. Beginning at the fundus of the gall-bladder I am trying to separate the adhesions by blunt dissection. Now it is possible that we may get into some pus while doing this. Now the gall-bladder comes into view. You see the liver. There is rather an excessive amount of hemorrhage here, mostly venous. We will wait just a few minutes until that venous hemorrhage ceases under the pressure of dry abdominal pads. It takes five or six minutes for coagulation to take place.

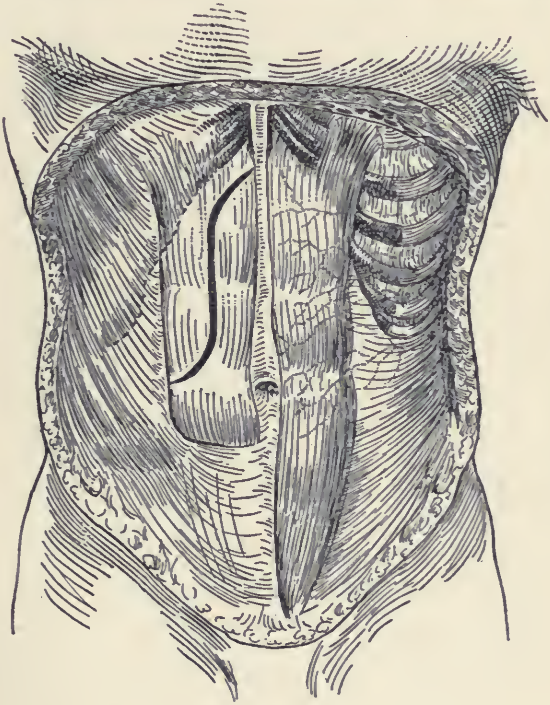

Fig. 6.—Bevan S-shaped incision in its relation to the right rectus muscle. The nerve-supply to the muscle is depicted on the opposite side. Note the relation of the lower end of the incision to the umbilicus.

As I get rid of this omentum and intestine, I continue my dissection and find a big stone in the gall-bladder. Now I have a great big distended gall-bladder to deal with here. I do not know what is in this gall-bladder, pus or mucus. There, I have opened into some pus. The gall-bladder is very friable. This is clearly a case where it is necessary for us to remove the gall-bladder. The under surface of the liver is exposed. The tissues are very vascular. If I could I would take the gall-bladder out from below. Now I have the hemorrhage fairly well controlled. It is from the under surface of the liver. The gall-bladder is full of pus and gall-stones. The hemorrhage is pretty well controlled by pressing a sponge in between the surface of the liver and the gall-bladder and making a little tension. I have gone down to the surface of this cystic duct, which I have pretty well isolated. I have put a clamp both on the cystic duct and cystic artery, a clamp with a full curve that we have introduced in this clinic for this particular purpose (see Fig. 2). Now I am going to take off that lower clamp and apply a catgut ligature.

We have now removed the gall-bladder, and I think we have the hemorrhage controlled. This is rather a trying case from the standpoint of the doctor and the standpoint of the patient. Now we will watch for a minute to see if we have the hemorrhage controlled. I am under the impression that a dry pad is better to stop hemorrhage. A wet pad is better for peritoneal surfaces. Now we will put in a Mikulicz pad. That whole omentum is oozing. I do not want to remove it. There will be two lessons in this for you. First of all we will put in two cigarette drains because we want very good drainage. We shall carry them down to the stump of the cystic duct. Then in this large oozing cavity I will put in this iodoform gauze to control the hemorrhage.

Now, what will happen here? This woman will get well. I think the risk is at least 5 per cent. because the gall-bladder was full of pus and because of the considerable hemorrhage that occurred during the operation. What will happen will probably be that there will be a certain amount of primary wound secretion and possibly escape of bile. There is no evidence of stones in the common duct. There is a possibility of a general peritonitis because undoubtedly a certain amount of this pus was poured out in the space between the liver and the upper surface of the colon. I am rather inclined to think that there is more danger of a localized peritonitis than a general peritonitis. I do not think there is one chance in twenty, however, of her having peritonitis. There is greater danger of fatal termination from pneumonia or some of the other postoperative lung complications which are responsible for most of the deaths after cholecystectomy. This might be either a lobar pneumonia, a bronchial pneumonia, or, in addition to the lung complications of that type, such a thing as a pulmonary embolism may develop and be the cause of death.

You might ask why I did not do a cholecystotomy instead of a cholecystectomy. My answer is that there would be a blocking up of the cystic duct and a permanent mucous fistula had I simply removed these stones.

The immediate after-treatment should be normal salt solution by rectum, intermittently, 10 to 12 ounces every three hours, and morphin, beginning with $\frac{1}{4}$ grain and repeating in $\frac{1}{6}$- and $\frac{1}{4}$-grain doses hypodermically until the pain is controlled. In the normal course of events the stitches should be removed in ten or twleve days. One drainage-tube will be taken out in three or four days and the other a few days later, then a gradual removal of the gauze, so that it will all be out at the end of six or seven days. That should be done by softening the gauze with peroxid and removing a few inches at a time. One of my colleagues who was operated upon some time ago, and who had to have his wound packed with iodoform gauze, was wise enough to insist on a gas anesthesia when the gauze was pulled out. He had pulled out so much gauze and hurt so many patients that he knew how much pain it caused. I much prefer not to use such a gauze pack, but it was necessary in this case. A good big surface of the omentum larger than my hand was bleeding where we stripped it off from the gall-bladder.

To continue our discussion of the natural history of cholelithiasis: Another thing that often happens is that the patient goes to Carlsbad or some springs and lives on a moderate diet, takes more exercise, and the gall-stone attacks become very much less frequent. Hundreds of people, thousands of people go to Carlsbad every year to have their gall-stones cured. Now we know that no chemical will dissolve gall-stones inside the human body, but it does happen under this kind of treatment, with more exercise, limited diet, and moderate saline catharsis, that the attacks become less frequent. This is the benefit of the so-called medicinal treatment. There is no doubt that it reduces the number of gall-stone attacks in many cases, but it does not cure gall-stone disease. The gall-stones remain latent.

The diagnosis of gall-stone disease is made by the history of the attacks of hepatic colic, the character of those attacks, the character of the pain, the location of the pain, the radiation of the pain from the right upper quadrant to the back and to the right shoulder-blade, the tenderness and the location of the tenderness, and the exclusion of other pathologic conditions, such as duodenal ulcer, kidney stone, and chronic appendicitis, that might give a similar picture. In the case of an obstruction of the cystic duct we may find, as in this case, a palpable gall-bladder. In the case of an obstruction of the common duct—jaundice. In ball-valve obstruction of the common duct—intermittent jaundice; an attack of jaundice lasting a few days, then disappearing, because the ball-valve stone floats up as the edema and inflammation of the mucosa disappears and allows the bile to pass. An impacted stone in the ampulla—a progressive jaundice, a deepening jaundice. In all cases of stone in the hepatic duct—jaundice.

In jaundice of any type due to gall-stone disease the development of a complication known as cholemia occurs. It is not uncommon for the jaundice cases to develop a chronic nephritis or a subacute nephritis, and eventually coma and death. In a case of cholemia the simple operation of cholecystotomy under local anesthesia, putting a tube into the dilated gall-bladder and relieving the jaundice by draining the bile to the outside, may be followed by death from a parenchymatous oozing from the mucous membrane of the gall-bladder or an oozing from the line of incision. We all know that every surgeon has experienced a number of deaths from hemorrhage due to this tendency of cholemic patients to bleed—a symptomatic hemophilia. On this account we sometimes hesitate to operate upon a patient with jaundice.

Another condition that develops in the natural history of this condition is an associated infection of the pancreas. It occurs in cases where there is a stone in the common duct by an extension of the infection through the pancreatic ducts that open into the common duct and through the tissues of the pancreas itself, with resulting fat necrosis and hemorrhage and possibly the sloughing of the pancreas, or, if the process is chronic, to the formation of a chronic interstitial pancreatitis.

Another thing that may develop in the natural history of this condition is carcinoma, due to chronic irritation from the presence of gall-stones in the bile tract. I must say that it is not certain just what relationship gall-stones have to cancer of the bile-ducts, although surgeons accept the proposition that the chronic irritation of gall-stone disease may be an important factor in the development of carcinoma. In the natural history of this process we may have rupture of the gall-bladder, general peritonitis, and death.

One picture that may develop in these cases is that of gall-stone ileus, if you use the term "ileus" in the wide sense of the word. It can be of the mechanical type, the result, for instance, of a big stone ulcerating its way from the gall-bladder into the duodenum, and, second, of the paralytic type. A woman like the one who was just operated on may develop in the course of a gall-stone attack a definite ileus. She bloats up and the abdomen becomes tremendously distended. She cannot pass any gas from the rectum. There is usually a good deal of pain, and sometimes the process goes on to a fatal termination. The postmortem shows that death was due to paralytic ileus, the result of a localized peritonitis around the bile tracts, all this producing the same clinical picture that you find in connection with mechanical ileus, and not infrequently, as I have said, a fatal termination.

As a result of the experience we have had in this clinic with gall-stone surgery I would like to give you the following conclusions:

Whenever the diagnosis of gall-stone disease can be made with a reasonable degree of probability the patient should be given the benefit of surgical therapy except in a few cases where, because of age or organic lesions, a surgical operation carries with it unusual and great risks. In such, good judgment may indicate medical management. Where the gall-bladder is fairly normal without any thickening of its walls, and where there is no stone in the cystic duct, the operation of cholecystotomy may be selected. We are, however, doing more and more the operation of cholecystectomy—in probably 90 per cent. of our cases—because in such an uncomfortable percentage of our cholecystotomies we have been required to do a secondary operation and remove the gall-bladder. Our mortality in our cholecystotomies has been about 1 per cent. It has been a little higher, about 2 per cent., in the cholecystectomies, but I believe that the mortality has been less in our primary cholecystectomies than in the cases where we have done cholecystotomies if we add the mortality from the secondary operations that have been required. When the stones are in the cystic duct, a cholecystectomy is always indicated. With stones in the common duct the usual direct choledochotomy should be performed with thorough drainage, continued, as a rule, for at least ten days. In the small number of cases where the stone is impacted in the ampulla a transduodenal choledochotomy, as suggested by McBurney, should be performed. The mortality in the common duct cases is probably somewhere from 5 to 10 per cent. There are a few cases of gall-stone disease associated with chronic interstitial pancreatitis where a cholecystenterostomy may be indicated. And, finally, we should insist upon a very wide exposure of the field, which will enable us to do our work throughly and easily, and give us such complete access to the bile tracts that there will be little chance of our overlooking a stone in the cystic or common ducts—an accident which, unfortunately, so frequently happens in operations done without sufficient exposure and careful search.

11-17-17 [illegible]

GENERAL PRINCIPLES OF THE OPERATIVE CURE OF INGUINAL, FEMORAL, AND DIAPHRAGMATIC HERNIAS. DEMONSTRATION OF THREE CASES

Summary: Frequency of hernia; outline of the development of the modern operation; the methods of Czerny, Wölfler, Bassini, and Andrews and the indications for each; transplantation of fascia rarely desirable; the anatomy of inguinal hernia; precautions—danger of pulmonary infarcts, bronchitis, and pneumonia; choice of suture material—silver wire a failure—catgut the best—stitches should approximate, not strangulate, tissues; place of the local anesthetic—technic of its use—its necessity in cases of strangulated hernia—twenty-five operations under aposthesine; etiology of hernia—the preformed sac; the anatomy and operative cure of femoral hernia; diaphragmatic hernia—diagnosis and cure.

October 12, 1916.

We happen to have 2 cases of hernia which we shall operate upon this morning, one a femoral hernia and one an inguinal hernia. We shall do the femoral hernia, because of the man's condition, under local anesthesia. He has an old emphysema and a heart lesion which make a general anesthetic contra-indicated. We shall do the inguinal hernia under a general anesthetic.

I want to give you a rather brief sketch of the subject of hernia. In the first place, hernia is exceptionally common. Macready, from the study of a large number of statistics, came to the conclusion that hernia occurs in about 12 per cent. of the males and in about 2 per cent. of the females, that is, about one man out of eight some time in his life has a rupture, and about one woman out of fifty. This, of course, includes all varieties of hernia. The common forms, as you know, are due to congenital defects at three weak points in the abdominal wall—the inguinal region, the femoral region, and the umbilical region. The other forms of hernia, such as obturator, sciatic, hernia of the linea alba, diaphragmatic hernia, and postoperative hernia, are comparatively rare when we compare them with the common forms. Now, inguinal hernia is the hernia of the male; femoral hernia is very often regarded as the hernia of the female, and yet a careful study of statistics shows that inguinal hernia is more common in both male and female. In other words, we have really an enormous percentage of inguinal hernia in the male as compared with the female. In the female femoral hernias are comparatively more common than in the male, but the total of inguinal hernias in the female outnumbers those of the femoral. The umbilical hernias, outside of those that occur in children, are much more common in the female than in the male.

I want to give you a very brief outline of the history of hernia from the standpoint of the modern operation for its cure. Until 1878 no operations were done for the radical cure of hernia that could be regarded in any way as successful. A number of methods had been employed up to 1878, such as subcutaneous wire suture of the sac or the injection of some irritating substance into the sac, like tincture of white oak bark, with the idea of producing an obliterative inflammation. Of course, long before that period thousands of hernias had been operated upon for strangulation, but I am referring now to the operation for the radical cure of hernia. In 1878 Czerny, who died the other day in Heidelberg, and who was an assistant of Billroth, devised an operation for the cure of hernia which consists in cutting down upon the hernia, isolating, ligating and removing the sac, and then suturing up the external ring. That was the first step. The second step was invented by Wölfler. Wölfler split up the external oblique, which covered in and was in front of the inguinal canal, an operation which he called the "Kanalschnitt." He added to the work that Czerny had done (simply isolating the sac, ligating it, removing it, and sewing up the external ring) the procedure of removing the sac high up at the internal ring and sewing up the canal, thus obliterating the canal from the internal ring to the external ring. In 1886 Bassini published an operation which he had been doing for several years, and which was the next great step in advance in hernia work. He added to what Czerny and Wölfler had done the elevation of the cord from the canal, closing the canal under the cord, and then putting the cord down over the closed canal and closing the other structures, the external oblique and superficial tissues, over this displaced cord. Wölfler added also another very important step in the development of hernia; that was to provide for special protection in very large openings by transplanting the rectus muscle and the rectus sheath. Now I will draw these various steps on the board.

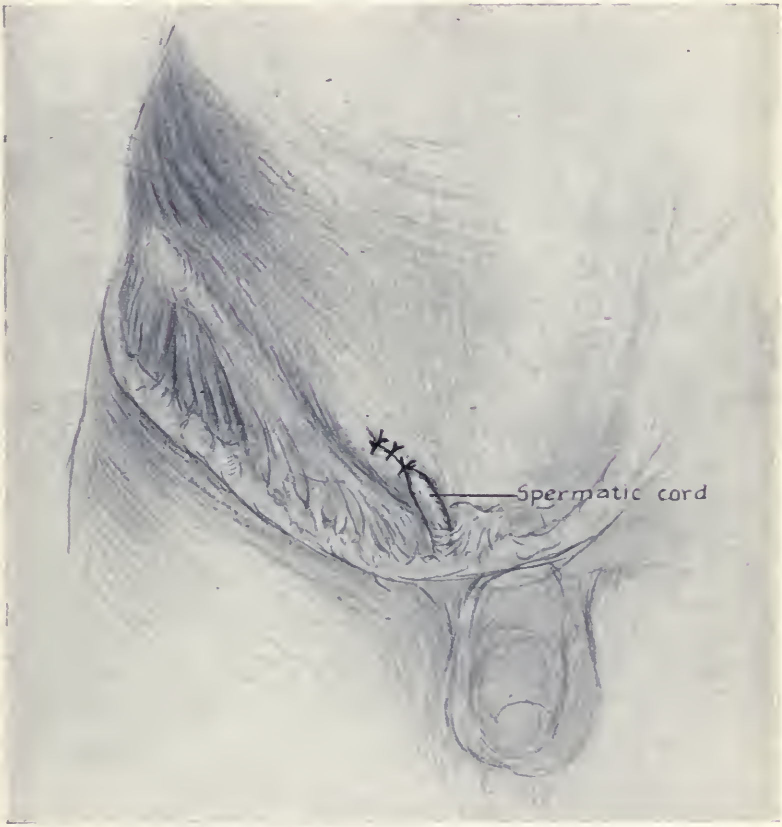

Fig. 7.—Czerny's operation. Sac cut off and external ring closed by suture.

Here is the abdomen; here is Poupart's ligament. Czerny's operation was simply ligating off and removing the sac at the external ring when this was tied, so that he left simply a stump at that point. Then the ring was closed with suture (Fig. 7). Now the next step, Wölfler's "Kanalschnitt," was to split up the external oblique from the external ring to the internal ring and then to remove the sac high up at the internal ring. The canal was closed by sewing the internal oblique and transversalis to Poupart's ligament over the cord (Fig. 8). Then the Bassini step was to elevate the cord with a blunt hook and close the canal under the cord (Fig. 9).

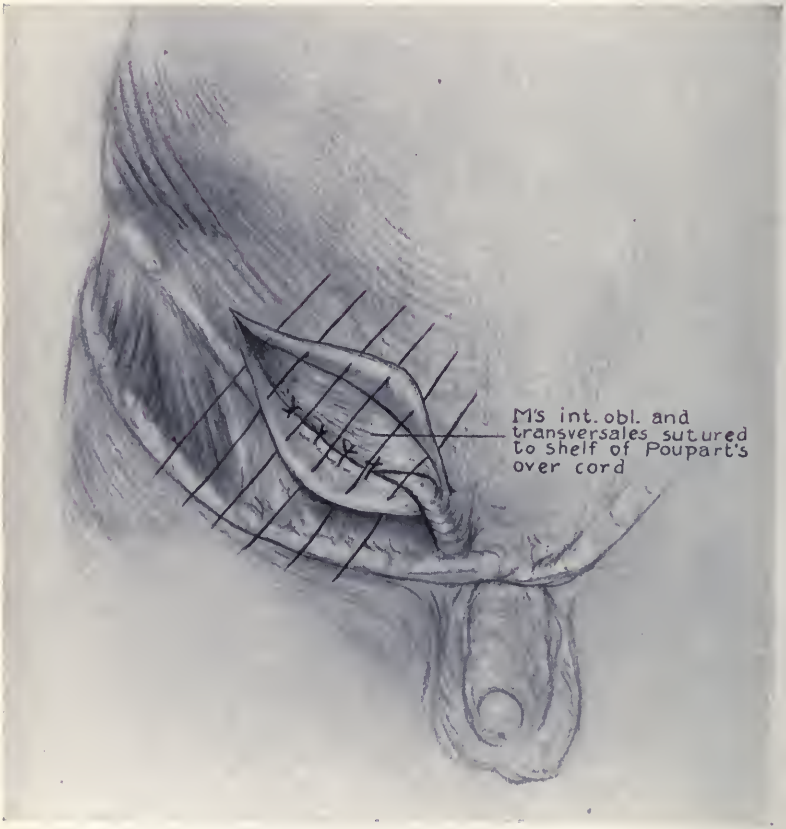

Fig. 8.—Wölfler's "Kanalschnitt" operation.

Now the next important step was Wölfler's second operation, which was this. Here is the rectus muscle coming down in this way on this side. Wölfler found in very large hernias that he was apt to have recurrences, so, in addition to the steps that I have just described, he would split open the sheath of the rectus muscle by an incision there, and then he would pull out the muscle like this and sew the rectus muscle to the shelf of Poupart's ligament (Fig. 10).

The next step which has been of value is that of the imbrication or overlapping of tissues (Fig. 11). That was done independently by a number of men—Lucas-Championnière, Girard, and Wyllys Andrews, of this city. There you have very briefly presented the various steps that have gone to make up the modern hernial work: Czerny's simple work, in 1878, of removing the sac and sewing up the external ring; Wölfler's work, a few years later, of splitting up the canal, removing the sac at the internal ring, and sewing up the canal; Bassini's work of elevating

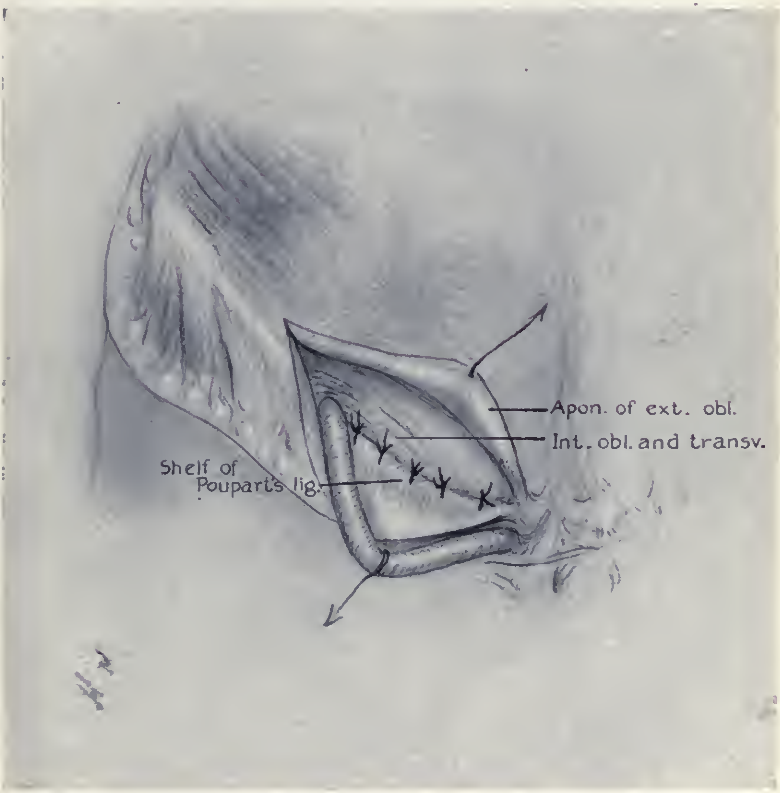

Fig. 9.—Bassini operation. Transplantation of cord and suture of internal oblique and transversalis muscles to the shelf of Poupart's ligament.

the cord and closing the canal under the cord; Wölfler's plan of closing the rectus muscle in large hernias in order to fill that defect; then the process of imbrication or overlapping the various layers in order to give strength. I want to say that you have here all that is of value in hernial work. There have been hundreds of men who have entered this field and suggested improvements. There have been dozens of other plans suggested, such as the

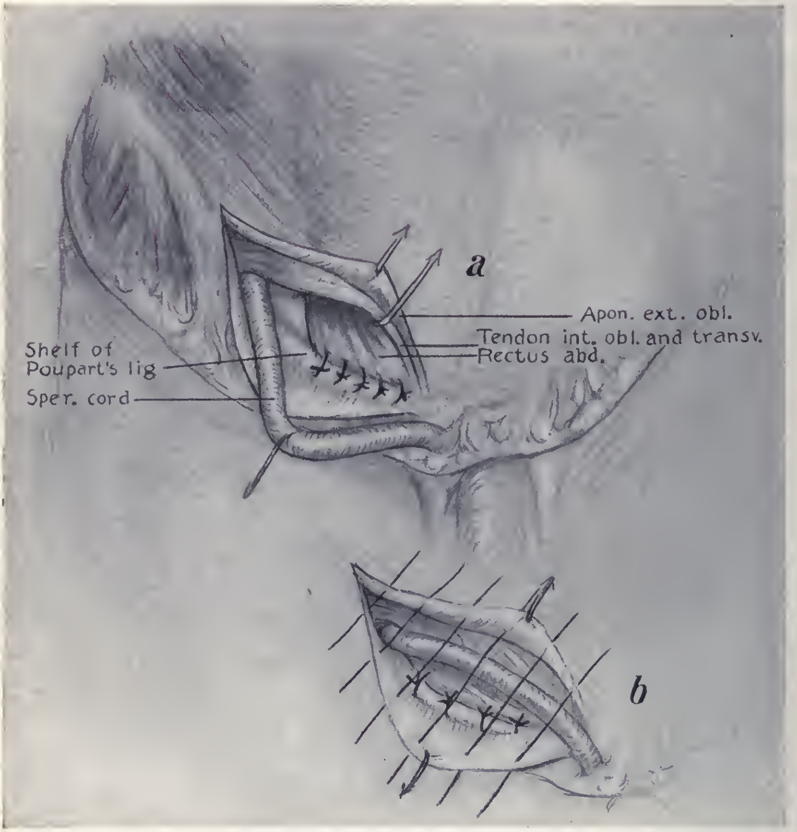

Fig. 10.—Wölfler's operation for closure of large hernial openings: *a*, Rectus muscle sutured to the shelf of Poupart's ligament; *b*, internal oblique and transversalis muscles sutured to Poupart's ligament. The cord has been transplanted and the anterior wall of the new inguinal canal is about to be formed by the closure of the incision in the aponeurosis of the external oblique.

work of Macewen, which for a time attracted a great deal of attention; the work of Kocher of elevating the sac, twisting it high up, which is still done in Kocher's clinic and a few other clinics; the transplantation of fascia, which has been done away with because of the more satisfactory transplantation of the rectus muscle and rectus sheath; the filling in of large hernial defects with filigree wire, putting into the hernial defect silver wire, like the wire-screen we have to protect the windows against flies and mosquitoes, with the idea that this foreign body would form a bulwark of value in large hernial defects, etc.

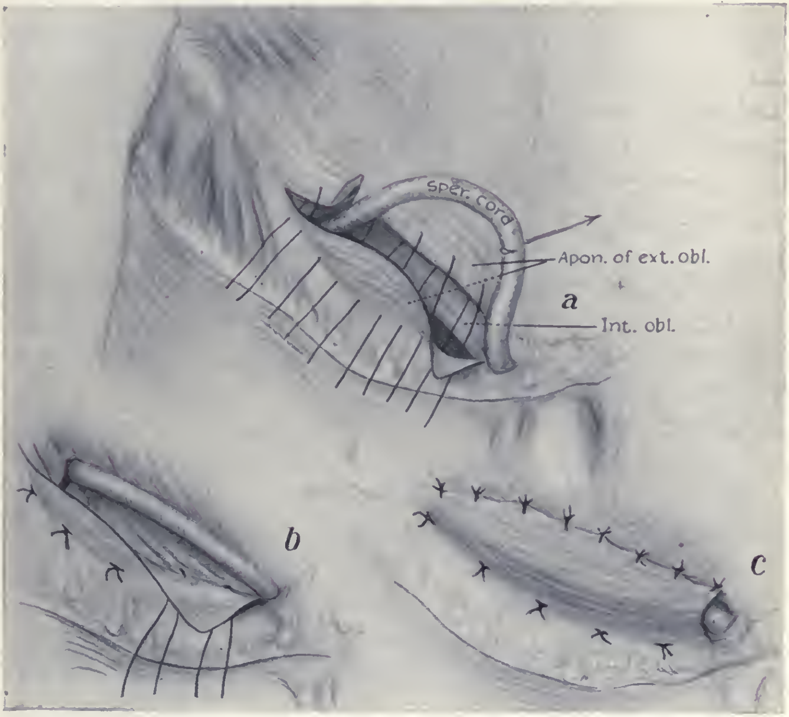

Fig. 11.—Andrews' imbrication method: *a*, Cord elevated and sutures placed in the first step in the actual imbrication, *i. e.*, the suture of the superior edge of the incision in the external oblique aponeurosis to Poupart's ligament to form the posterior wall of the new inguinal canal. Note the notch in that aponeurosis near the upper angle of the incision for the reception of the cord; *b*, sutures tied and cord dropped into position; *c*, flap of external oblique aponeurosis stitched over spermatic cord to complete the new inguinal canal.

Another thing I want to mention very briefly is the sutures that have been used in hernia. Early, silver wire was used; then some men became very enthusiastic about kangaroo tendon. Some men still bury silk in hernia. Some operators did very poor work in connection with hernia by using a lot of silver wire. They thought for a time that it was much the best procedure. They said they seldom saw the silver wire work out in the further history of the case, but other surgeons saw many of their cases and had to remove the silver wire. We gradually came back to the rather simple proposition of catgut. That was reliable; that could be depended upon. For a time chromicized gut was used a good deal because it was supposed to last longer in the tissues than ordinary catgut and so was more desirable. Gradually, however, we learned that any good catgut, such as iodin catgut, lasts long enough, that is, until wound healing is complete, and so practically all over the world today catgut is the suture that is employed in hernial work.

In regard to the anesthetic: Hernias have been very generally done under general anesthesia in the past. The majority of hernias are possibly best done under general anesthesia. Since the introduction of cocain a good many efforts have been made to do hernial work under local anesthesia. Harvey Cushing, Professor of Surgery at Harvard, but then associate in surgery at Johns Hopkins, devised a very good technic for hernial surgery with cocain early in the history of local anesthetics. At that time I did 50 or more hernias under cocain infiltration anesthesia. Cocain had the objection of great toxicity in certain cases. A number of sudden deaths followed the use of cocain as a local anesthetic; it did not prove entirely satisfactory and so was very generally discarded. With the introduction of novocain we found an anesthetic about one-eighth as toxic as cocain and which, with the addition of adrenalin, produced very satisfactory local anesthesia, and today we preach the doctrine that as far as the anesthetics are concerned, the ordinary hernia, where the patient is a good surgical risk, can be done either under ether or under a local anesthetic. Strangulated hernias should all be done under local anesthesia. I shall elaborate upon that point later on.

OPERATION

Now for a moment we shall discontinue this general discussion and operate on this case of inguinal hernia. Our object is to expose the inguinal canal. The landmark is the external ring in which I have my finger. Now I shall make the incision from the external ring upward and outward, on a line with a point about an inch medially from the anterosuperior spine and parallel to Poupart's ligament. You should know your geography here very well. It is not sufficient to do what an old Rush graduate once told us he used to do when he was practising in northern Minnesota before the days of radical cure, when he operated on a strangulated hernia. He said he used to cut down through the skin and superficial fascia and then damn carefully until he got to the gut. That was the extent of his anatomy. That will not do. You want to know the anatomy and know it thoroughly.

Our incision penetrates first the skin and superficial fascia. Here we come to some vessels in the superficial fascia which are branches of the femoral artery and vein. You can ligate these or else you can simply clamp them. These three vessels are the superficial epigastric, the superficial external pubic, and the superficial circumflex iliac. We have only divided two of them here. Now we divide down to the external oblique. With three retractors we will expose this field. Here is the external ring. I have my finger in it now. We will divide the tissues over the external ring pretty well parallel to the fibers of the external oblique. I want to call your attention to the structures that come into view. That white structure on my forceps, about the size of a good size fiddle-string, is the ilio-inguinal nerve just beneath the external oblique. We leave it alone. It is not very important, but it is well not to interfere with the innervation of this region. Now I pick up the upper flap of the external oblique; I shall turn it back and expose the internal oblique. Then we take the other fold of tissue (the external oblique fascia below the incision) and follow it down to Poupart's ligament. That fine silver-like structure is Poupart's ligament. I expose the shelf of Poupart's ligament. The next step will be the division of the two layers of fascia that are common to the sac and to the cord.

Those are the cremasteric fascia and muscle and the transversalis fascia. They are rather fine structures. I am dividing now the cremasteric fascia and muscle and the transversalis, and as I divide them we will bring into view the sac. It is the white fibrous tissue that is on the sponge now. I can wipe this sac off from the structures of the cord which are the spermatic cord and the remnants of these layers of fascia which we have just divided. I will do this slowly. The vas comes into view. See this white structure on my finger now. That is the vas. You want to be careful about any injury to the vas, for the vas in this case is very intimately associated with the sac. Now, then, we have separated the sac from the cord and can proceed to open it. You see I can pass this grooved director right into the sac and into the abdominal cavity. It is a very small sac and nothing came out here except a little strand of omentum. The patient had a good deal of pain from a partial strangulation a short time ago. With the hemostats holding it open, we now transfix the sac, ligate it, and cut it off, leaving a stump about ½ inch in length. Now the sac has been disposed of. So far we have done nothing but what Wölfler did way back in the early eighties, and I do not believe any further dissection will be necessary in this case. We will simply do the operation of closing the canal, replacing the cord in its normal position. Now let me caution you to use very great care in exposing this cord, because not infrequently after hernia operation you get a lung infarct. How does a lung infarct occur? A lung infarct occurs as the result of thrombosis in some of the spermatic veins, usually from rough handling or infection. It goes through the general circulation to the heart, then through the pulmonary artery to the lung, and sometimes a fatal pulmonary embolism results. Lung infarcts are very common after hernia operations.

Now I pick up a good ½ inch of this red muscle, and sew it to the shelf of Poupart's ligament. Now watch me tie this suture. I do not tie it tight. I do not want to cut through the muscle. I simply want to bring the muscle up snugly to Poupart's ligament. I do not want to strangulate it, like you cut off a hemorrhoid with a ligature. Now I pick up again a good ½ inch of this muscle and again the shelf of Poupart's, and with three or four stitches we can close this canal very nicely. I think that will be enough. I have only put in three. We have a very small hernia to deal with. Now the next step will be sewing up the external oblique. You see this is a very simple operation, but it is one that will be very efficient in this particular case. Now the external oblique is sewed up. Remember that the superficial fascia here is a vascular layer, and in order to get that vascular layer well over your line of incision put in a couple of very fine buried catgut sutures through the superficial fascia. Now we look and see if there is any bleeding. There is some bleeding here. We will ligate that one point so as to have the wound perfectly dry.

We are attempting to put the skin stitches in pretty evenly and without tension. There is one thing you want to learn in abdominal surgery and all other kinds of surgery, that is, that stitches are put in to approximate and not to strangulate tissues. It is a very difficult thing to get men to put in stitches properly. Most everybody wants to pull them tight. Sometimes, of course, in surgery, when you want to control bleeding, it is important to pull a stitch tight.

The wound will be dressed with a simple dry dressing and a good spica bandage. There is no objection to having that man sit up tomorrow if he wants to and no objection to having him stand up tonight and urinate or get on a commode to urinate. He will probably have a little ether nausea and a few gas pains. If this heals perfectly, as we expect it will, the stitches will be taken out on the eighth day and he will leave the hospital the ninth or tenth.

REMARKS

Now as regards the fate of the catgut. The catgut will last twenty days, long enough for wound healing to be completed, and then it will be absorbed. There are some risks in this operation. The risk of the general anesthetic is probably 1 in somewhere from 5000 or 10,000 if the man is a good surgical risk. The main complications that we have found have been the lung complications, and these occur probably in 2 per cent. of the cases. Probably one man out of fifty with a perfectly straight hernia will have some lung complication, either an infarct, a bronchitis, or a pneumonia. Immediately after the operation the one thing you want especially to look after is the patient's urinating. Many of these patients cannot urinate if they lie in bed. Most of them can urinate if you allow them to stand up. It is desirable not to allow the bladders to become overdistended, necessitating the use of the catheter. The catheter always carries with it a certain amount of risk of a cystitis.

The percentage of cures in a case like this would be very high, probably 99 men out of 100 with an operation of this kind would be cured permanently of the hernia. That percentage would not hold if applied to all sorts of hernias. Taking it all in all, we are curing about 19 out of 20 hernias that come to the clinic by operation. That, however, would necessitate your adopting proper methods in each case. In simple cases simply removing the sac and sewing up the canal will suffice; in difficult cases with large openings a more complete operation, such as the Bassini transplantation of the cord, the imbrication method, or Wölfler's transplantation of the rectus. In cases with large rings, either a hernia of the direct type, where the internal ring is immediately behind the external, or in what Gunn used to call a straight hernia, which is a large oblique inguinal hernia that has lasted so long that the internal ring had been carried down opposite the external ring, the transplantation of the rectus is necessary in order to secure a good result.

Returning to the general discussion of hernia, I want to emphasize one point that has been brought out in the last few years in regard to the etiology. The important factor in the occurrence of hernia is a preformed hernial sac, a congenitally existing hernial sac. Now that is true whether the hernia is inguinal, femoral, or umbilical. For a long time we used to believe that these hernial sacs were produced by the hernia coming down through its weakened opening. That is no longer accepted. An Australian by the name of Russell a few years ago first called our attention to the fact that in most inguinal hernias and in most femoral hernias long before the hernia occurred there was a peritoneal sac projecting through the canal. Let me give you an illustration: A man of twenty-five in perfectly good health and an athlete has never had a hernia. He goes to stool one morning and strains because his bowels are very much constipated, and all of a sudden he has a very violent and severe pain in his right groin, he looks down and sees a big swelling in his groin, running down into his scrotum. A surgeon is called and finds he has a large inguinal hernia which has apparently suddenly developed. He cannot reduce it and puts the patient under ether and operates, opens up the hernia, and finds 20 inches of the small intestine and some omentum down through the canal and in the scrotum and a large peritoneal sac. Now that peritoneal sac did not develop the instant this man was at stool and pushed this inguinal hernia down. That sac was there before. That sac was there before with a rather contracted, small neck. Under the pressure of the straining at stool that contracted neck was opened up and out shot into the sac 20 inches of the small intestine. That is the picture of a hernia and a pre-existing peritoneal sac. We know now, because our attention has been called to this fact, that a careful dissection will show in a large number of cadavers without any hernia these pre-existing small peritoneal sacs in the inguinal region, in the femoral region, and in the umbilical region. We know from our study of undescended testes, and we have operated upon about 300 cases of undescended testes, that even when the testicle has never been out of the abdomen and there is no hernia, we find a long peritoneal pouch preceding the testicle and passing through the canal down to or into the scrotum. In other words, the old belief that the testes brought down the peritoneal pouch into this position is erroneous. The peritoneal pouch is a pre-existing pouch.

CASE II

This patient is an old German who has a femoral hernia. We will operate under local anesthesia. Novocain, which is a German preparation, is no longer on the market, and we are using apothesine, a synthetic preparation made in America, which we have found to be quite as satisfactory if not more so than the German preparation. Usually I tell these patients that a hernia can be done under a local anesthetic with much less discomfort than having an ordinary tooth filled. Sometimes I tell the patients in operations about the face, where we can control the entire field perfectly, that I will promise them, outside of the first injection, it will not hurt any more than having a shave. There is no sensation in the infiltrated area. The pulling and pressure makes pain in the surrounding structures, and one has to handle these structures with great care to prevent any pulling that can be transmitted to the underlying sensitive structures.

The armamentarium: First of all a very fine hypodermic needle, the ordinary morphin needle and syringe, is used to infiltrate a small area, and then a larger syringe and needle can be painlessly used to complete the infiltration. We will surround this entire field with a hollow sphere of infiltrated tissue. You see the infiltration progresses. Can you see it go on? Now we can make this incision if it is a femoral hernia either vertical and parallel with saphenous vein or, as preferred in many cases, parallel and just below Poupart's ligament. The strength of this solution is $\frac{1}{2}$ of 1 per cent. and about $\frac{1}{100,000}$ of adrenalin, the same as novocain.

Now we divide through the skin and superficial fascia and we come in contact with the same vessels we did in the inguinal hernia, the superficial circumflex iliac, the superficial external pubic, and the superficial epigastric, coming up through the cribriform fascia. The patient says he has no pain. Now in the pulling of this sac there will be a certain amount of pain. The technic under local has got to be carried out with a great deal more care than in a general anesthetic. Here is a great vein right in our way and we will ligate and divide it. That is the internal saphenous vein. You see gradually there comes into view a mass of fat projecting from the femoral ring. Now we have our whole hernial sac pretty well isolated and very much the same picture that we had in the femoral hernia we operated the other day. There is the fat. That is the main mass. It is pretty hard to see the sac. It is so thin. It will be rather interesting for you to make a study of the tissues to see what this fat is. Now there is fat and fat, and there are a number of kinds of fat. I cannot even tell you yet whether that fat is subperitoneal fat or whether it is omentum. We will investigate it a little farther and see definitely. I am rather inclined to think it is omentum—at any rate we do not want to injure anything in here. There is some structure that I do not quite understand, some structure here right in the middle of the sac. Every once in a while you get a piece of bladder or of intestine in such a hernia. Here in the center of this fat is a peritoneal sac, a little pouch that I have opened now. I have this grooved director leading into the peritoneal cavity and I have four forceps on the sac. We ligate the pouch very high up and leave about $\frac{1}{4}$ inch of the stump distal to the ligature. Then we shove that stump right under and above Poupart's ligament. Now, you see, all this fat is subperitoneal fat.

I will put just one mattress stitch here. I want to be sure not to put that stitch through the femoral vein or through the femoral artery. There is the femoral ring. There is the pectineus muscle and there is Poupart's ligament. Now this stitch goes through Poupart's and through the pectineus fascia, and when tied it obliterates the ring (Fig. 12). The third step of the operation will be simply closing the skin wound. The sac is gone. Everybody knows that in a hernia there are two abnormal conditions—a peritoneal sac and a hole. You remove the sac and sew up the hole. Sometimes the hole is more like a canal, as in the inguinal region. Sometimes it is more like a hole. Here it is so short that you simply have to put in one mattress stitch for closure.

I want to emphasize the importance of the anatomy involved in this little operation. You see we made the incision parallel to Poupart's ligament, and we went through the three superficial branches of the vein and the artery and come down to the cribriform fascia. Then we came to a thin layer of fascia covering some fat. That fat here was not omentum, though it looked very much like it. It was subperitoneal fat. Right in the middle of the wound, looking like the ordinary peritoneum but very much thickened, was the hernial sac proper.

Now, you see, the patient has stood the operation very well. We have taken plenty of time on account of this demonstration.

The wound will be closed with one or two superficial catgut sutures and then the skin will be drawn together nicely with silk. The patient tells me he has had no pain during the operation. This apothesine is working out quite as well as novocain, and personally I am very grateful to the American chemists who are making us independent of Germany or any other foreign market for the drugs that we have to use in medicine. You know we are now getting a very good substitute for salvarsan in this country. Here is another example, showing that it is possible to make synthetics like novocain in America. After the war is over it will

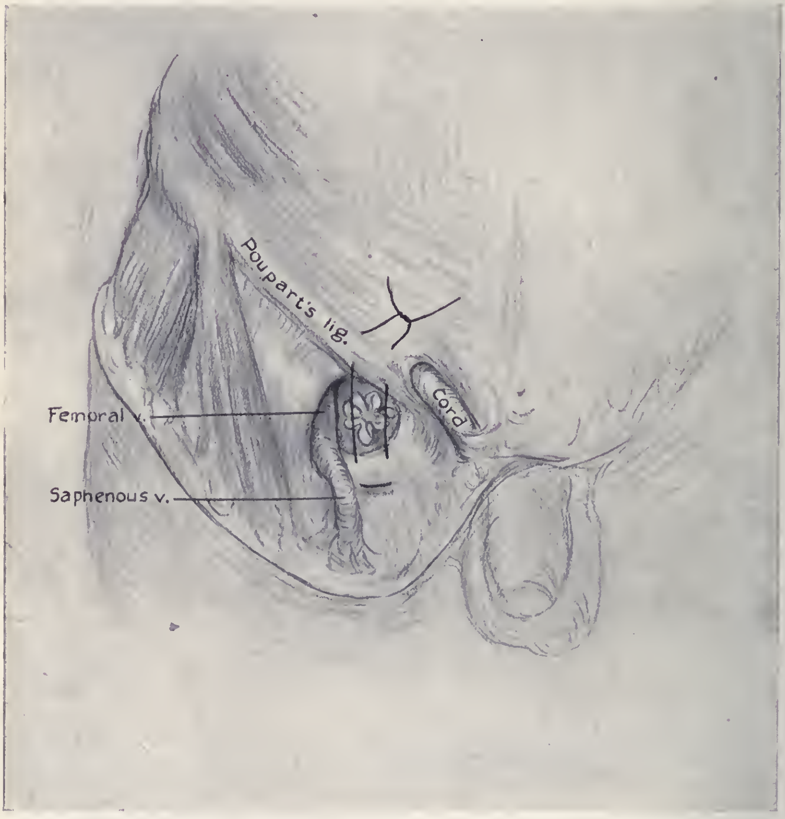

Fig. 12.—Mattress suture of catgut between pectineal fascia and muscles and Poupart's ligament. When this suture is drawn taut the femoral ring will be obliterated.

simply be a trade war as to who will furnish the best preparations at the most reasonable price. Practically all the synthetics that have been heretofore made in Germany are now being made over here.

I have recently used apothesine in 25 operations, including removal of inguinal glands, resection of rib and draining of lung abscess, circumcision, inguinal and femoral hernia, carcinoma of the face, synovial cyst on the back of the wrist, ligation of thyroid vessels, gastro-enterostomy, resection of rib and draining subphrenic abscess, a very extensive thyroidectomy, removal of bullet from the thigh, removal of infected cyst of neck, and removal of tumor of the breast. We have used as large an amount as 5 ounces of $\frac{1}{2}$ of 1 per cent. solution. We have not noticed any toxic effects of any kind and no interference with primary wound healing.

I understand that the agent is being employed by one hundred surgeons in different parts of the country and that it will not be placed on the market until the experience of these men with the agent has been fully reported. My own experience with apothesine seems to point to its being a very satisfactory local anesthetic which meets the necessary requirements of being non-toxic, of not being decomposed by boiling for five or ten minutes, and of producing complete anesthesia which lasts in the neighborhood of an hour.

In regard to the after-treatment there is very little to be said. This patient will have his luncheon. It is now twenty-five minutes of 1. He will have his luncheon at 1 o'clock if he wishes it. I must say that I feel this way about the use of local anesthetics in operations. If I personally had a very serious operation, as an abdominal operation that required relaxation, I should have the surgeon do the operation under the best conditions and, in order that he would not be hampered by the movements of the patient or the rigidity of the muscles, I would take a general anesthetic, a straight ether anesthetic, drop ether. If I were to have an operation done on a strangulated hernia for myself I would insist that a local anesthetic be used. I want to come back and dwell on this point for a moment, because it is in many ways the most important point I am presenting to you this morning. In the case of a strangulated hernia you have many complications to contend with. One is shock. Often the patient has great shock. A more important complication is vomiting. One of the constant or almost constant accompaniments of strangulated hernia is vomiting. Vomiting carries with it in this case sometimes a peculiar danger. I have seen patients die on the table in the hands of an expert anesthetist by drowning themselves, in cases of strangulated hernias that had existed for some time, where the stomach and entire alimentary tract were full of fluid material. Shortly after the first profound anesthesia the vomitus just pours out, not pints but quarts of material from the stomach, from the intestinal tract, and the patient actually drowns on the table. In the same way patients that are operated upon for strangulated hernia may not drown on the table, but they drown after they are put to bed or they may get an aspiration pneumonia. Now, because of these facts, local anesthesia is peculiarly indicated in cases of strangulated hernia. I want every one of my pupils who does any surgery, unless we have some other means presented to us of greater value, to use, in strangulated hernias, a local anesthetic. I have gone so far as to say that it is not good surgery to use a general anesthetic in cases of strangulated hernia. Now again, this man, you see, stands his operation very well. He has hardly turned a hair, to use a common expression, during the operation. I think we hurt him once slightly when we pulled up that mass of fat with the peritoneum in it because we made traction on the peritoneum. The local anesthetic, I should say, should be used in quite a proportion of hernias, and as a rule now I take the position of using it always in strangulation or in any serious lesion where your patient is a bad surgical risk, and then the other cases I would leave open to the patient. You cannot very well operate on a child with a local anesthetic. You must have the co-operation of your patient. You cannot very well operate on a hysteric patient with a local anesthetic, but, as a general proposition, I submit the facts to the patients and let them choose between a local and general anesthetic if they are ordinary good surgical risks. I want to say that some patients are profoundly impressed with the value of a local anesthetic. Not very long ago we had a very well-to-do patient in the hospital who had a great dread of having his umbilical hernia operated on under general anesthesia. He came down here and was operated under local. You can do a beautiful umbilical hernia operation under local with practically no sensation to the patient. He was so delighted with the result that a couple of days after the operation he called me into his room and gave me a check for $5000 for the surgical department of the hospital, saying, "I want to express my great appreciation for the way the hospital has taken care of me." I simply cite that to show you that

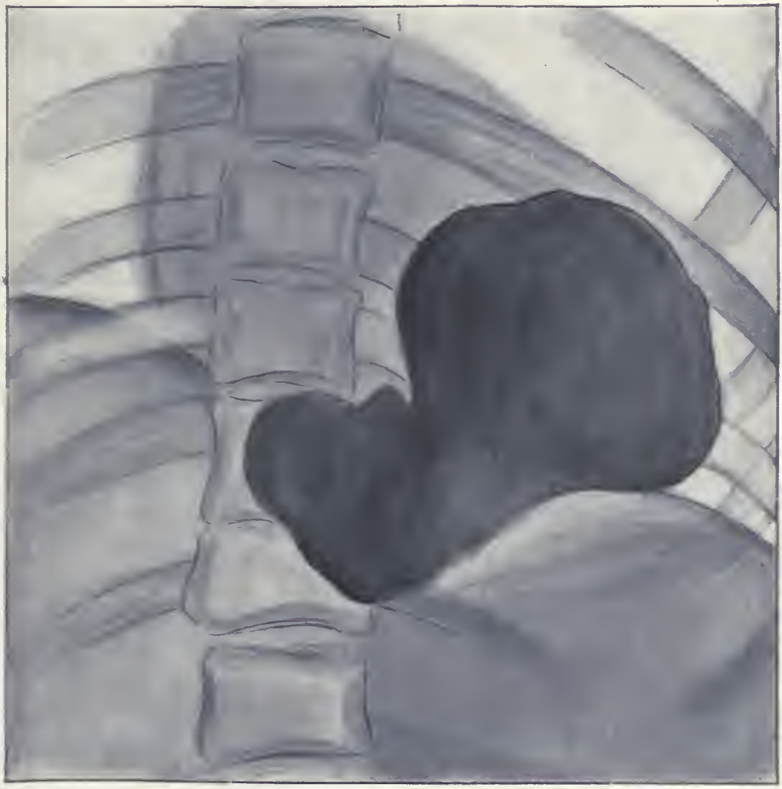

Fig. 13.—Diaphragmatic hernia. Sketch of x-ray plate before operation. Note the large shadow lying above the diaphragm.

individuals are very appreciative of good work done under local anesthesia.

CASE III

As one of the rarer forms of hernia I shall now show you a case of diaphragmatic hernia recently operated upon.

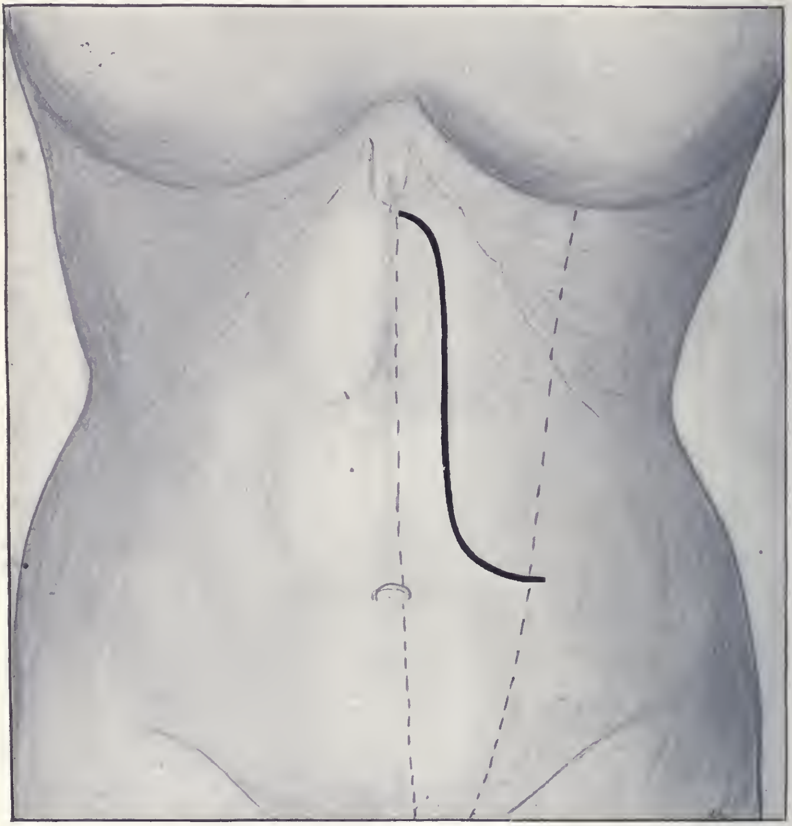

Fig. 14.—Diagram showing S-shaped incision for gall-bladder work adapted for use to the left of the median line.

This lady, of about forty-five, had some very acute, severe attacks of pain in the region of the stomach. These would come on at irregular intervals some time after eating, would increase in severity for an hour or more, and would then be relieved by vomiting. She had consulted a number of physicians, and the diagnosis remained obscure until she came to see Dr. Bertram W. Sippy, who, after analyzing the facts, was able to make the definite diagnosis of a diaphragmatic hernia in which one-half or possibly more of the stomach passed through an opening in the diaphragm into the thoracic cavity. This was beautifully shown by x-ray plates taken after the patient had swallowed a bismuth meal, as shown in Fig. 13. Dr. Sippy asked me to see the case with him, and we finally decided upon an operation.

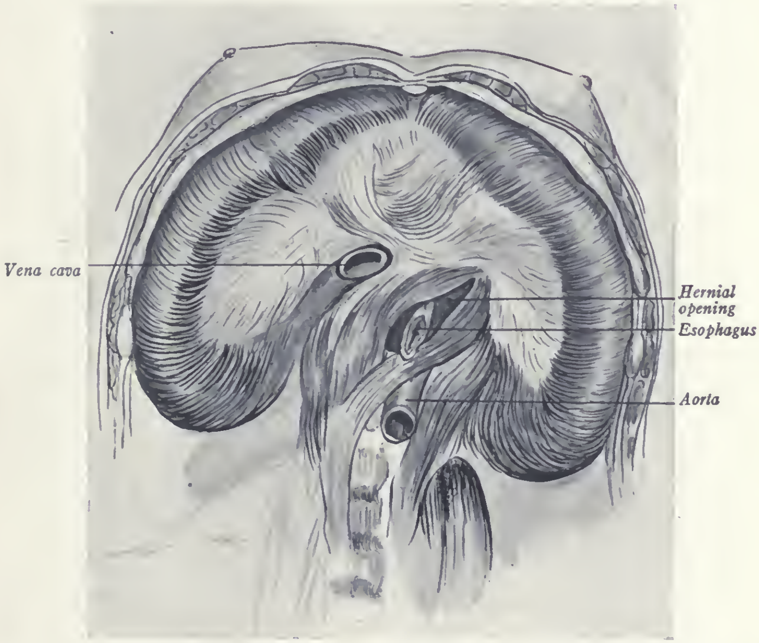

Fig. 15.—Diagram showing position of hernial opening and its relation to the aorta, vena cava, and esophagus.

The operation was done under ether anesthesia and I made a large S-shaped incision through the left rectus muscle, such as I employ in the right rectus muscle for extensive bile-tract operations. This S-shaped incision in the left rectus is shown in Fig. 14. On opening the peritoneal cavity and making a wide exposure of the left upper quadrant, I found that about one-half of the stomach had passed into the thoracic cavity through an opening which proved to be an abnormally large esophageal opening, or rather an opening in front of the normal esophageal opening, as shown in Figs. 15 and 16. Without much difficulty the portion of the stomach in the thoracic cavity was pulled down into the abdominal cavity and the opening in the diaphragm was

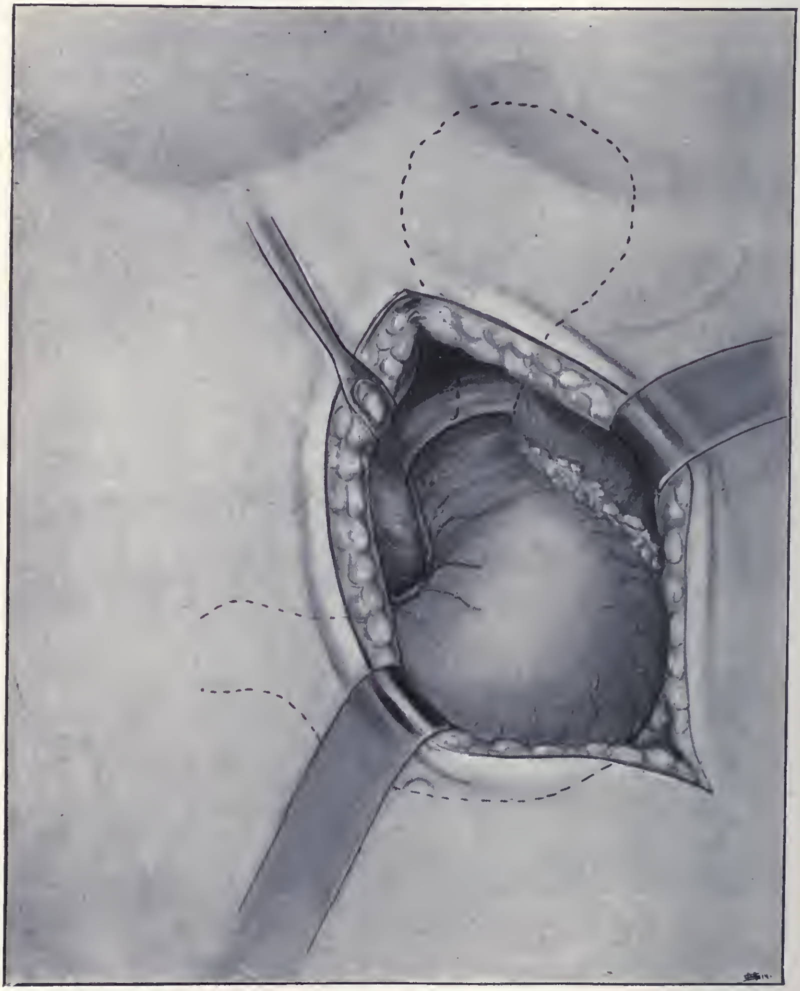

Fig. 16.—Diaphragmatic hernia. About one-third of the stomach with a portion of the omentum is in the thoracic cavity.

sewed together with catgut sutures, as shown in Fig. 17. In order to insure further against recurrence the stomach was sutured to the diaphragm by a number of sutures, as shown in Fig. 18. The external incision was then closed without any drainage and the patient went on to an uninterrupted recovery from the operation.

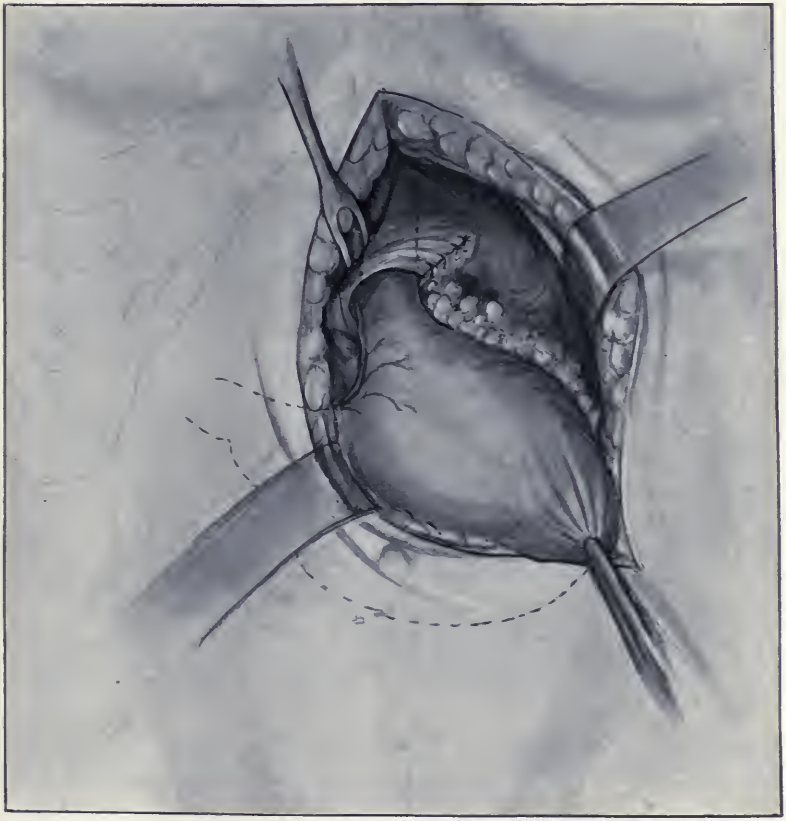

Fig. 17.—Hernia reduced and the opening in the diaphragm closed by suture.

The after-history was most satisfactory—a bismuth meal showed the stomach in its normal position below the diaphragm, as in Fig. 19, and since the operation she has had no recurrence of her old attacks.

I am demonstrating this case especially to emphasize the fact that these diaphragmatic hernias of the stomach do occur, that they can be diagnosed definitely by *x*-ray plates taken with the stomach full of a bismuth or barium meal, and I want also to emphasize the importance of the S-shaped incision, as described above, through the middle of the left rectus in obtaining a very good exposure, enabling the surgeon to make the necessary repair without difficulty.

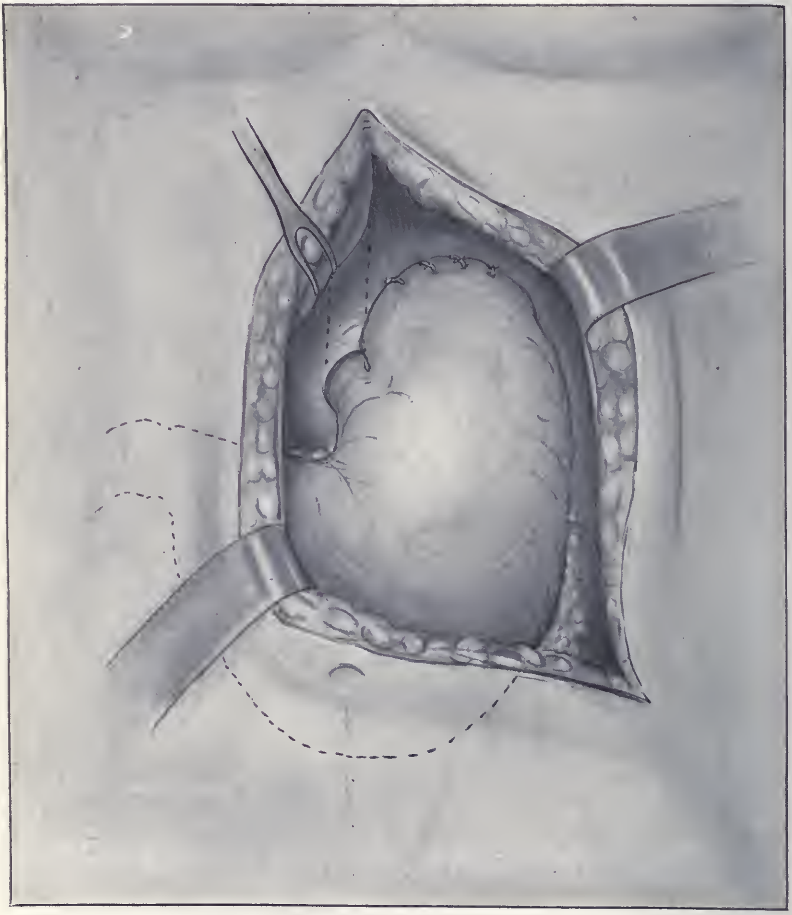

Fig. 18.—Stomach sewed to diaphragm around hernial opening to insure against recurrence.

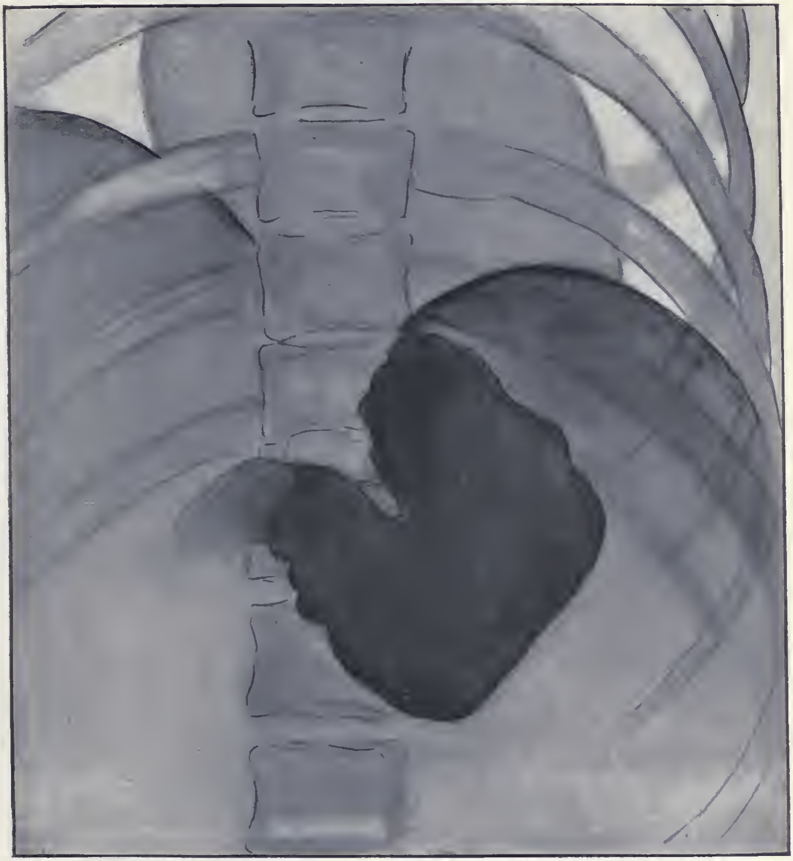

Fig. 19.—Sketch of *x*-ray plate after operation. Note that the barium shadow is now entirely subdiaphragmatic.

CLINIC OF DR. A. J. OCHSNER

Augustana Hospital

GOITER

The Indications For and the Technic of the Surgical Treatment of Goiter, Illustrated by Three Cases

Summary of the three cases:

Case I.—Progressive growth of an adolescent goiter greatly influenced by the menstrual periods in a girl of twenty-four years: Medical treatment of no avail. Anesthesia in thyroidectomy. Family history of goiter.

Case II.—Exophthalmic goiter. Technic of operation. Infected tonsils and goiter.

Case III.—Exophthalmic goiter. A study of the pulse during the operation. After-treatment of surgical cases.

CASE I

October, 1916.

Clinical History of the Patient.—A young girl, twenty-four years of age, was admitted to the hospital on October 18, 1916. There have been several goiters in the family. Her mother, her mother's mother, and her six sisters, all of whom are living, all have goiters. The goiters are all large nodular ones, and none of them have produced symptoms requiring surgical treatment. Her mother's goiter did not begin to develop until the age of forty-two years, after the birth of her last child. The mother has become somewhat nervous and excitable during the past year (she is now forty-six years old), but since she is passing through her menopause this trouble is probably due to the menopause. The family has always lived near Lake Michigan.

Past History.—The patient had scarlet fever at two years and typhoid fever at seven years of age. There was an abscess in the left eye when four years of age, which has caused total blindness of that eye. At present she wears an artificial shell eye. Her menses began at thirteen years, are regular, with but slight backache the first day, and the flow is somewhat scant. The last period was on September 20, 1916.

Present Complaint.—At the age of thirteen, when she first menstruated, there was noticed an enlargement of the right side of the neck. There were no other symptoms. At each menstrual period there has been a sensation of fulness and swelling in the neck and the tumor has grown somewhat larger each month. During the past year the left side of the neck has grown larger, and she has experienced sensations of choking and some difficulty in swallowing, especially pronounced at the time of her menses. She has never been nervous or excitable and has no cough. She never feels the beating of her heart except after undue excitement and she does not think her pulse ever becomes rapid. The vision in the good eye is unimpaired. Otherwise she is quite well.

Physical Examination.—The left eye is markedly shrunken and the cornea is entirely sclerosed. There is no sense of light or dark.

Neck.—There is a very marked diffuse enlargement of all lobes of the thyroid gland. The right lobe is the largest and is 9 cm. long and 7 cm. wide. There is a little difficulty in breathing.

Comments.—DR. OCHSNER: This patient has had efficient medical treatment during the past two years, during which the goiter has progressively increased in size. Because of this fact, and because she is past the age of puberty and is beginning to have pressure symptoms, we have decided to remove this goiter. Her reason for wishing to have it removed is that it is large and unsightly and interferes with her breathing.

She was given $\frac{1}{4}$ grain of morphin and $\frac{1}{100}$ grain of atropin hypodermically one-half hour before beginning the anesthetic. We do this so as to reduce the amount of anesthetic to be given to a minimum, because the morphin will overcome the sensitiveness of the patient so that she will not feel our manipulations and the atropin will prevent her from inhaling mucus, which would otherwise accumulate in the pharynx. That is of great advantage, first in preventing her from coughing during the operation, and in the second place it prevents pneumonia following the operation. The anesthetic is given until the patient is absolutely asleep and she is kept in the recumbent position during all this time. After the patient is deeply asleep, the head of the table is elevated to an angle of 45 degrees, so as to produce an anemia of the brain; that will serve to make what anesthetic she has received effectual during the operation. We will not have to give further anesthetic during the time that the operation is in progress. By the time the operation has been completed the patient will have exhaled practically all the anesthetic that has been given, and when the table is lowered the patient will be wide awake and all the effects of the anesthetic will be over. Also the worry of a possible postoperative pneumonia will be over. Since we have followed this plan in over 500 cases we have not had one case of pneumonia following a thyroidectomy.

NOTE.—Through Kocher's transverse collar incision, three-fourths of all lobes of the thyroid gland were removed by the method described in the next case. It proved to be a large diffuse colloid adenoma with areas of hemorrhage and fatty degeneration. The patient was permitted to sit up in bed directly after returning to her room and to sit out of bed in an easy chair on the following day. There was an uneventful recovery and the patient left the hospital on the twelfth day after the operation.

CASE II.—EXOPHTHALMIC GOITER

The patient, a married woman of thirty-seven years, was admitted to the hospital September 13, 1916, because of goiter.

One brother has pulmonary tuberculosis; the family history is otherwise negative. She had measles and whooping-cough in infancy. She had an abscess in the region of the coccyx, which lasted two weeks and had to be lanced. Menstruation began at fourteen, very irregular, two weeks between periods, as a rule. She has been married ten years. Has never borne children or been pregnant. Her husband is well. She sleeps and eats well. Bowels are constipated. She drinks tea but no coffee.

She comes to the hospital because of enlargement of the throat and difficulty in breathing. Four years ago she first noticed that the neck was enlarged. She has been very nervous for the past four years, but worse the last six months. She gets out of breath easily, but has noticed no palpitation of the heart. She has quite a tremor of the hands, but no exophthalmos.

Physical Examination.—The patient is a well-developed, poorly nourished woman. Face is flushed. There is no icterus. She is very nervous and excitable. There is no exophthalmos. There is a marked tremor of the protruding tongue. Both tonsils are markedly hypertrophied and cryptic and several necrotic stumps of teeth are present. There is a moderate solid enlargement of the left and middle lobes of the thyroid gland and a slight enlargement of the right lobe. There is a slight thrill felt over the tumor. Lungs and breasts are negative. Heart rate is 108. The sounds are regular and the heart is not enlarged. The abdomen is negative.

Comments.—DR. OCHSNER (Sept. 13, 1916): This patient is a bad risk, and I am not going to wear gloves, so that I may be able to do the operation as quickly as possible. A half-hour before the anesthetic was given this patient received $\frac{1}{4}$ grain of morphin and $\frac{1}{100}$ grain of atropin hypodermically. She has been thoroughly anesthetized with ether and then the head of the table was elevated.

We always use the transverse collar incision of Kocher (Fig. 20) because that makes an imperceptible wound that the patient can very easily cover up with a little string of beads, so that it leaves no deformity to annoy her later on. We are going to remove one side entirely. We make our skin incision, elevate the skin, fascia, and platysma muscle. The anterior jugular vein, which in a normal patient is so small that it can hardly be discovered, is larger in this case than the external jugular in a normal patient. We clamp these veins between two forceps and ligate them, and in that way we undoubtedly dispose of one of the sources of trouble in these cases, because it seems likely that the venous stasis which is accomplished in the presence of these large veins has something to do with the hyperthyroidism.

Now we separate the anterior muscles by means of a vertical incision extending down to the gland (Figs. 21 and 22). They are the sternothyroid, sternohyoid, and omohyoid muscles. The sternocleidomastoid muscle is so far back that it need not be considered in this case. As a rule, we find it necessary to divide the anterior muscles transversely in only 10 per cent. of our thyroidectomies. It is when these muscles are unusually tense and when the gland is unusually large and cannot be delivered through the retracted edges that we resort to section. When it is necessary, we apply two hemostatic forceps placed 2 cm. apart

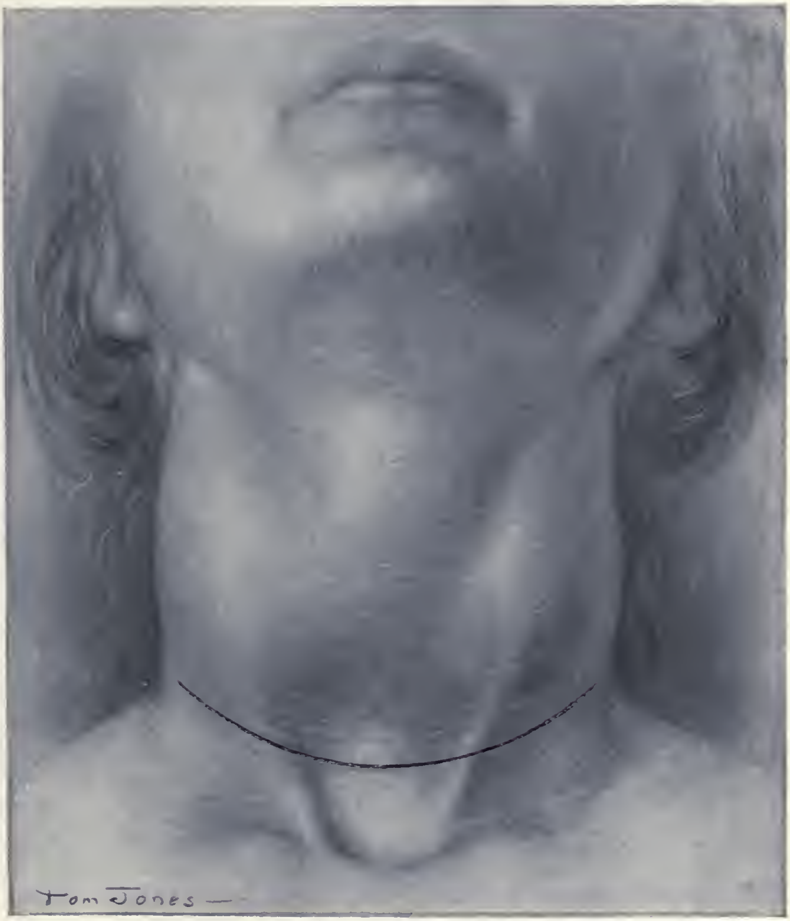

Fig. 20.—The Kocher transverse collar incision.

and cut between them. In this way the edges can be more easily sutured together after the gland has been removed.

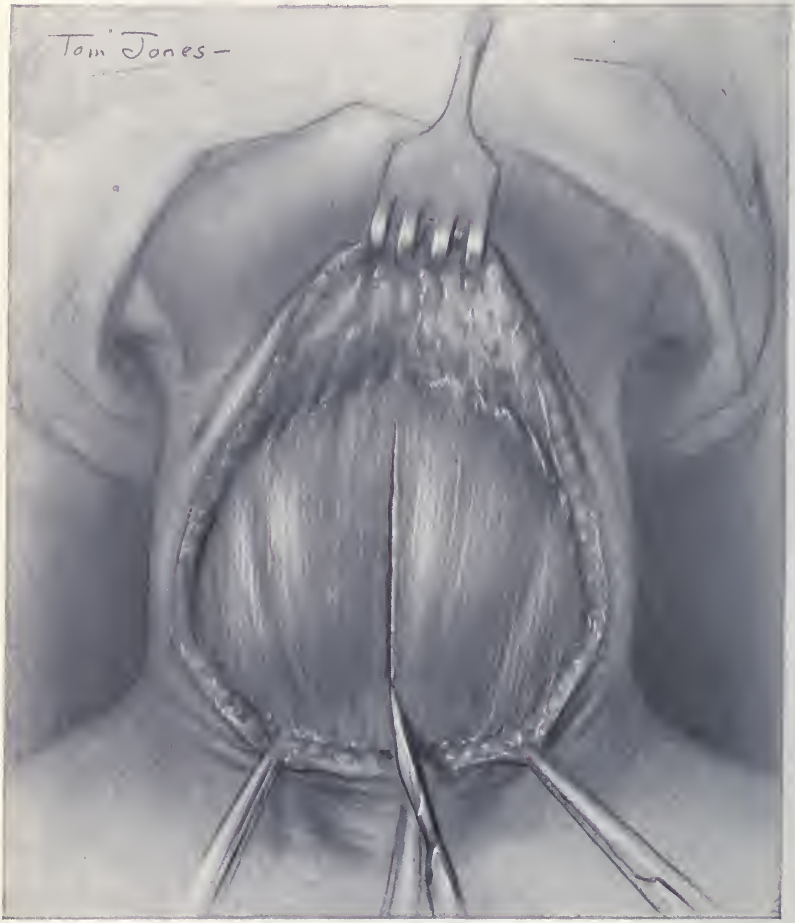

Fig. 21.—The skin, subcutaneous fat, and platysma dissected away from the anterior muscles and the flap so made reflected upward. Forceps applied to the subcutaneous vessels and kept in place throughout the operation. Midline incision separating anterior muscles.

The tumor extends under the sternum for a small distance and is entirely confined to the right lobe. We grasp the superior pole of the gland containing the superior thyroid artery and vein with two forceps on the proximal side and one on the distal side.

The two forceps on the proximal side are applied in order to prevent slipping, because if one of these forceps should slip, the other

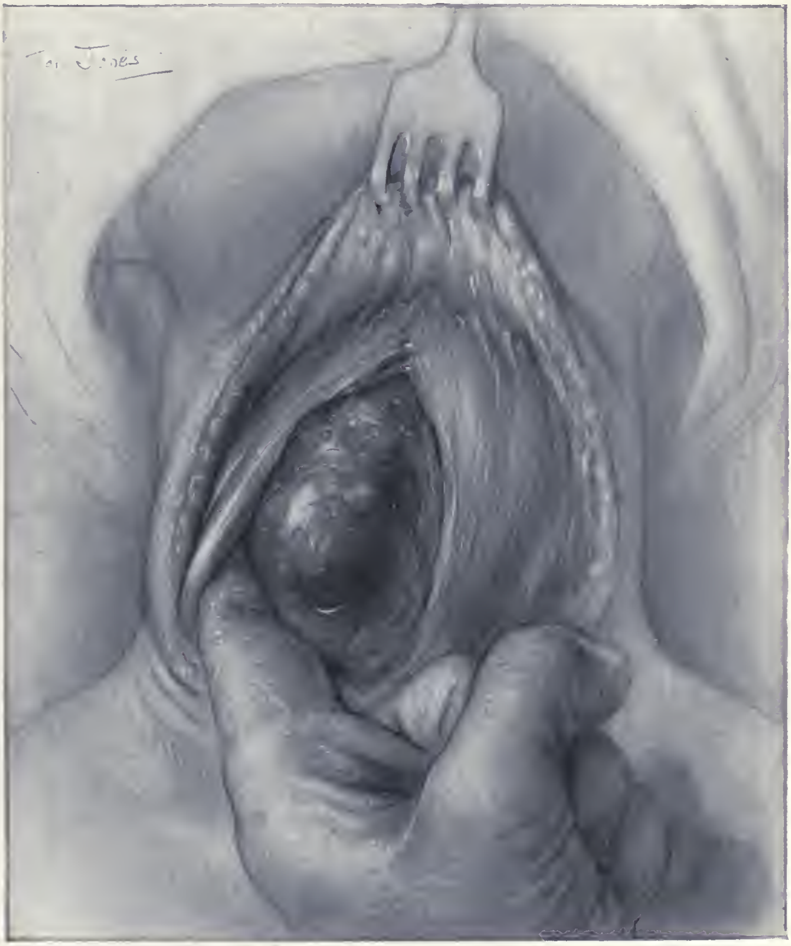

Fig. 22.—With the finger the anterior muscles are separated and the dissection carried down to the capsule of the gland. The same finger dissects away and dislocates the entire gland forward from its bed.

one will hold and prevent hemorrhage. The inferior vessels are then grasped within the substance of the thyroid gland, so that there is no possibility of infringing upon the parathyroid glands (Fig. 23).

We now make an incision through the posterior capsule, leaving a piece of this structure attached to the underlying tissues, 4 cm. in length and 2 cm. in breadth, covering the lower pole of the gland. This will insure a perfect protection of the lower parathyroid gland and the recurrent laryngeal nerve, be-

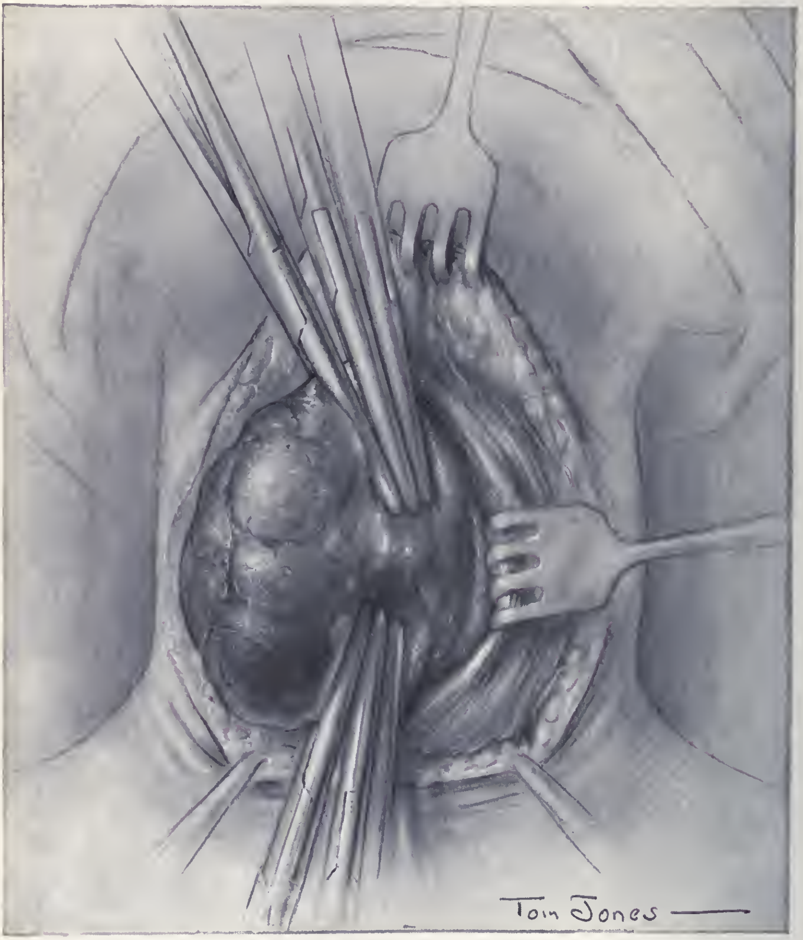

Fig. 23.—The inferior and superior poles of the gland are clamped with three forceps external to the posterior capsule. Note that the forceps are applied directly into the thyroid tissue and not outside of the capsule. The line of excision will be between the outermost and middle forceps.

cause at this point these two structures are located between the posterior capsule of the thyroid gland and the trachea, and so

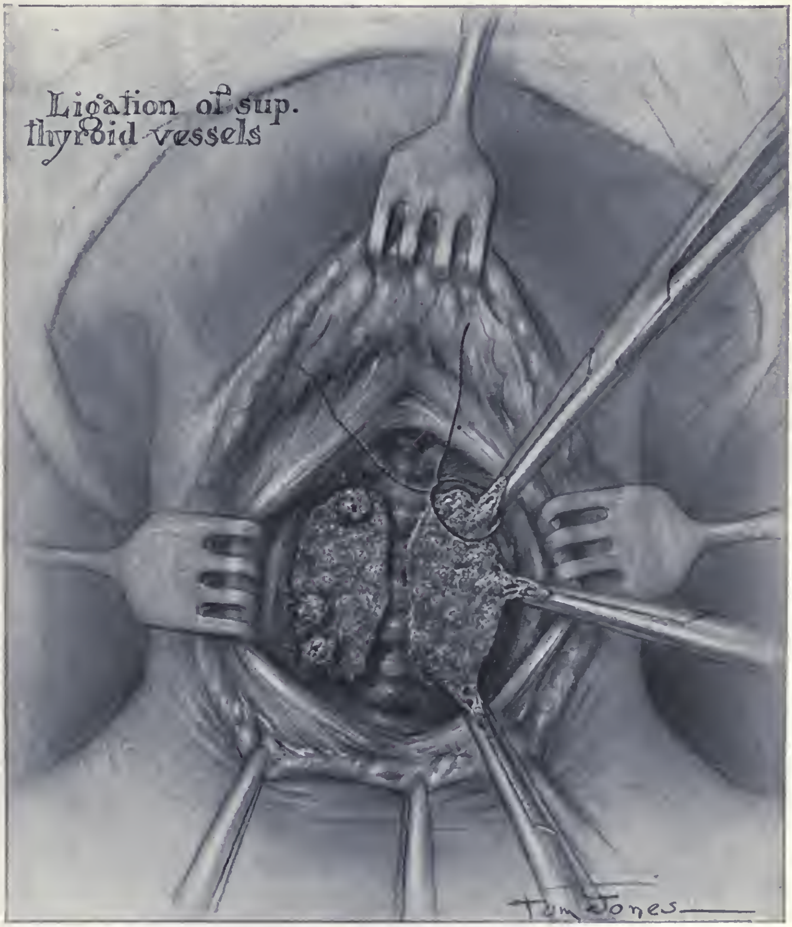

Fig. 24.—The right superior and inferior poles of the goiter with the contained arteries have been ligated. A second branch of the inferior is also ligated. These same vessels on the left side are ready for ligation.

long as we do not remove this portion of the capsule we cannot possibly injure either of these two important anatomic structures. Occasionally the parathyroid gland projects through the capsule on to the posterior surface of the thyroid gland, but even then it displaces the posterior capsule anteriorly, so that by being careful to preserve the posterior capsule at this point one can always be sure that he has preserved the recurrent laryngeal nerve and the parathyroid gland. In case there should be hemorrhage because of the slipping of the forceps attached to the inferior thyroid vessels, the greatest care must be exercised to prevent the placing of the forceps that are applied for the purpose of controlling the hemorrhage, either upon the parathyroid gland or the recurrent laryngeal nerve. At this point you see how the piece of the posterior capsule has been left in position (Fig. 24). Directly behind you can see the trachea showing through it. Between this portion of the capsule and the trachea we would find the recurrent laryngeal nerve and the lower parathyroid gland. It is possible to expose the recurrent laryngeal nerve at this point and recognize it as a little white line about the size of a fine sewing thread. This can be determined by following the inferior thyroid artery into the lower end of the thyroid gland. The nerve passes either in front of or behind the artery at this point. It is possible to isolate the inferior thyroid artery without difficulty at this point and ligate it separately, but the artery gives off a branch supplying the inferior parathyroid gland which is likely to complicate the work.

Other workers, notably in the foreign clinics, have used different methods in this part of the operation. Billroth tied the inferior and superior arteries quite close to the gland with separate ligatures just before removing the gland. Kocher first lifts the inferior pole and applies a ligature between the thyroid gland and the thyroid fascia, but as far laterally as possible so as to avoid the inferior thyroid body and recurrent laryngeal nerve. In this method, however, one must be exceedingly careful and painstaking in dissecting away the capsule. Since this space also contains the large inferior veins there is great danger of venous hemorrhage and embolism. De Quervain since 1911 has employed a ligature outside the external capsule or thyroid fascia. Finally, Dietreich and Langenbeck advocate ligation of the inferior thyroid artery at its origin on the outer side of the carotid artery. This is, of course, an unnecessary distance from the field of operation, and in so doing the sympathetic nerves have quite frequently been injured.

The plan we have described is very much simpler and infinitely safer, and consequently we make use of it entirely.

The urinalysis in this case showed a large amount of acetone, a small amount of albumin, and a considerable amount of diacetic acid, but no sugar. For that reason we are especially anxious to perform the operation with the administration of the smallest possible amount of anesthetic. The nervous condition of the patient made it an exceptionally unsatisfactory case. Ordinarily, as in this case, it is quite possible to finish the entire operation without the administration of additional anesthetic.

Because of the fact that many cases of goiter follow infections in the tonsils we always remove infected tonsils in these cases. We shall remove this patient's tonsils just before she is ready to go home and use local anesthesia in order to eliminate the danger of a second intoxication with ether.

CASE III.—GOITER

History.—The patient, a married woman of thirty-eight years, was admitted to the hospital October 4, 1916, because of an enlargement of the thyroid gland.

Her family history is negative. Her past history is negative except for typhoid fever when a child. Menstrual history is negative. Her bowels are constipated, and there is some frequency of urination due to injuries received when a child. Her weight is about normal.

She comes to the hospital complaining of a goiter and of a choking sensation in the throat and of nervousness. This started following a heavy cold during pregnancy. The gland gradually increased in size, and as it did the nervousness became more marked. She has a tremor of the fingers and has some headache in the occipital region, but this is not as frequent as formerly. She is very short of breath, especially on exertion, and has frequent attacks of palpitation of the heart. There is no pain in the abdomen or chest.

Physical Examination.—The patient is a well-developed and well-nourished female with good color. There is marked hypertrophy of both tonsils. There is a marked cystic enlargement of the right lobe of the thyroid gland extending below the sternum 1.5 cm. The enlargement is approximately the size of a small orange. On the left side the enlargement is somewhat less in size and is nodular. No bruit is heard or thrill felt. Her pulse is 88. The heart is slightly enlarged; that is, approximately 1 cm. to the left of the left midclavicular line. No adventitious murmurs are heard. There is a marked prolapsus of the uterus, bladder, vagina, and rectum.

Comments and Operation.—DR. OCHSNER (October 6, 1916): When this patient came up for the anesthetic her pulse was 140. Now she is thoroughly anesthetized after the method we always use in these cases and her pulse has come down to 80. Ordinarily the pulse does not come down as much as this. By giving $\frac{1}{4}$ grain of morphin and $\frac{1}{100}$ grain of atropin one-half hour before the operation, and then thoroughly anesthetizing the patient slowly with ether by the drop method, one can count on reducing the pulse about 25 per cent. of the excess above normal. For instance, if the patient's pulse is 150, or 80 beats above normal, you can count on its coming down to 130. Supposing the patient's pulse is 140, then you can count on its coming down to 120, and so on; counting the excess above 70, you can count on its coming down about 25 per cent., but the patient must be very thoroughly anesthetized while in the horizontal position and then the head of the table must be elevated to a point at which the body will make an angle of 45 degrees with the floor. The resulting anemia of the brain will then be sufficient to maintain the anesthesia throughout the period that is required to perform the operation. The advantage in using morphin before the operation, of course, comes from the fact that in the first place these patients during the half-hour which intervenes between the administration of the morphin and the administration of the anesthetic get quieted down, so when the anesthetic is begun the patient is in a quiet condition. Then the ether may be given by the drop method, and it acts as a stimulant and cannot possibly do the patient any harm. The patient becomes thoroughly anesthetized before you begin the operation. If you have the patient half asleep, and then begin to operate, the irritation is sufficient to spoil the anesthetic, but if the patient is thoroughly asleep, and you add to this an anemia of the brain by elevating the head of the table, then the morphin obstructs the sensitiveness, so the patient does not feel the incision and does not feel any part of the operation. She breathes quietly throughout the operation and leaves the table without any marked degree of shock. The advantage of the atropin is that its use prevents the accumulation of mucus in the pharynx. Since we have followed this plan of anesthesia in more than 500 cases we have not had one single case of pneumonia following goiter operation, because the patient does not inspire the mucus. When the patients go back to their beds you can have them sit up immediately. Much has been said about the harm that can be done by ether anesthesia in connection with goiter operations. As a matter of fact, ether anesthesia when produced by the drop method is not one particle worse than it is to become intoxicated with alcohol, and becoming intoxicated with alcohol does no harm provided it happens only once in a lifetime.

You see how careful I am in making the incision because this is a very large goiter and I wish to have space enough to lay it bare thoroughly. The left lobe extends underneath the sternum. Pulling the goiter causes her to breathe noisily because with this lobe I pulled up the trachea. I will be careful to leave enough thyroid tissue to carry on the normal secretion.

We take great care in ligating, particularly the superior and inferior thyroid vessels, because if there should be a retraction of these vessels there would be a serious hemorrhage. By grasping each one of these vessels with hemostatic forceps before they are severed we are able to remove this gland without losing more than a few drams of blood. We leave in every instance an amount of gland tissue about equal to the tissue contained in a normal gland. If we remove one lobe, the other lobe contains a sufficient amount of tissue. If we remove one entire lobe, we leave behind a portion attached to the posterior capsule. If the second lobe is also enlarged, we leave a sufficient amount of this to supply the necessary amount of gland tissue to prevent the occurrence of myxedema.

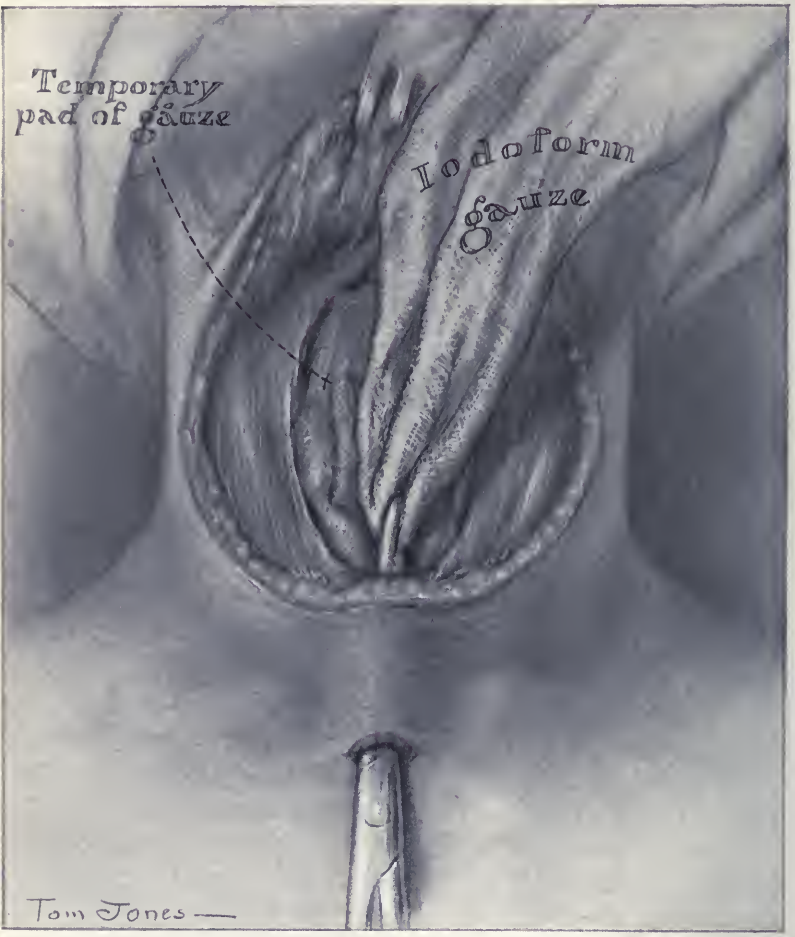

Fig. 25.—The goiter has been removed and a pad of gauze inserted between the anterior muscles and the stump of the gland in order to control the capillary oozing. A transverse button-hole incision is made 1 c.c. below the suprasternal notch and a pair of forceps has dissected a tunnel down to the space originally occupied by the goiter, and a strip of iodoform gauze and a Kocher perforated glass drainage-tube carried through the tunnel. The temporary pad of gauze is then removed and the iodoform gauze takes its place, and the anterior muscles are approximated with a continuous line of catgut sutures.

Now I have ligated all the vessels, and the surface from which we remove the gland is perfectly dry. We make a small transverse button-hole incision through the skin 4 cm. below the lower

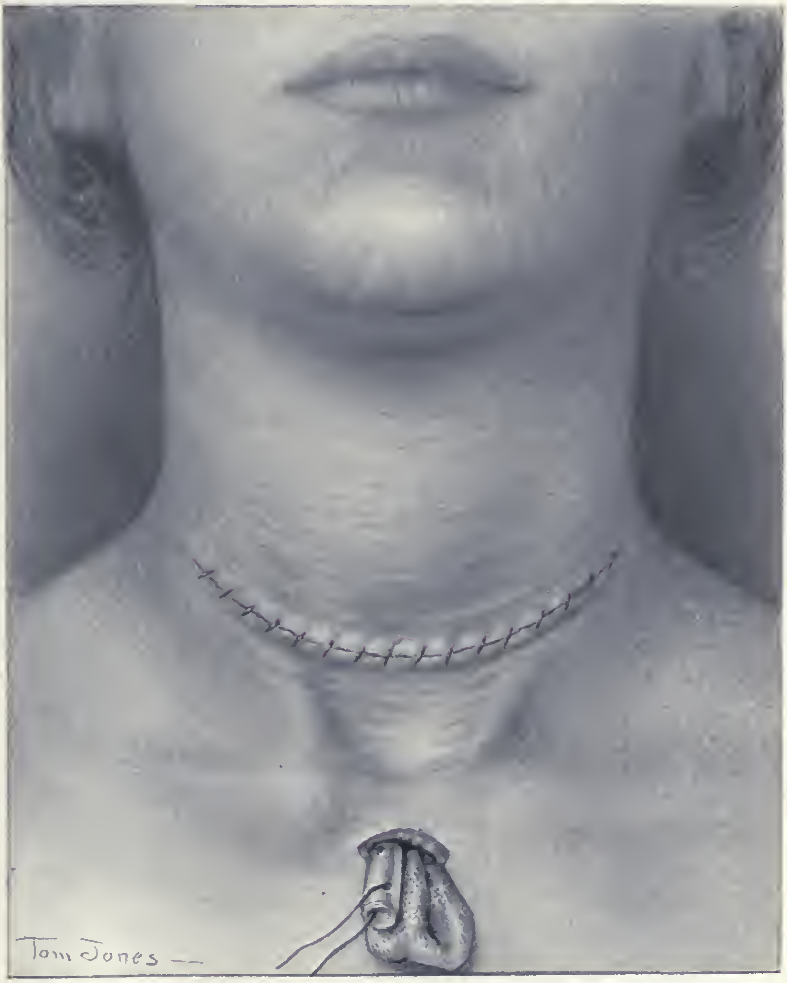

Fig. 26.—Four subcutaneous catgut sutures have been applied to take the tension off the flap. A continuous row of horsehair sutures are then applied to approximate the edges. The Kocher tube and strip of gauze are seen emerging from the stab incision.

edge of the wound, and pass a pair of hemostatic forceps through the connective tissue underneath the edge up into the space from which we have removed the gland, so as to make a drainage canal. We then draw a strand of gauze through this opening 3 cm. wide and sufficiently long to cover the entire raw exposed surface, so that any discharge will be taken up by this gauze. Then a Kocher glass drainage-tube is passed through the opening and the inner end placed over the gauze, so that a considerable accumulation of fluid may pass out of this drainage-tube during the first few hours (Fig. 25). We next unite the muscles on the anterior surface of the neck with catgut stitches. A few subcutaneous catgut stitches are applied between the upper and lower skin-flaps in order to remove the tension which would otherwise be demanded of the final horsehair skin sutures (Fig. 26).

A dry gauze dressing is applied with moderate pressure and held in place with adhesive strips. Over this dressing is applied a large cotton pad, and the entire neck and upper chest is bandaged with a large soft gauze roller bandage.

After-treatment.—The after-treatment of these cases is very important. This patient will be sent down to her room and the head and shoulders will be elevated upon a head-rest. Proctoclysis with 500 c.c. of normal salt solution, started every four hours and given by the Murphy drop-method, will be instituted at once. She will be given sips of hot water this evening and tomorrow she can have all the water she will drink. If her pulse continues to rise after the operation and if she becomes highly excitable she will be given $\frac{1}{4}$ grain of morphin sulphate and $\frac{1}{100}$ grain of atropin sulphate, and one-half hour later will be given a hypodermoclysis of 1000 c.c. of normal salt solution in the pectoral region. This is usually sufficient to prevent the occasional postoperative thyrotoxicosis, but sometimes it is necessary to repeat this procedure several times during the following two or three days. She will sit up out of bed on the second day and be allowed to walk on the third day. Proctoclysis is discontinued the second day when water is given freely by mouth. Bland liquid diet is allowed on the third and fourth days and on the fifth day a soft "goiter diet," a copy of which follows, is begun.

The Kocher glass drainage-tube is removed on the second day and the gauze carefully removed on the fourth day. On the seventh day the horsehair stitches are removed, and on the tenth to the twelfth days the patient is allowed to go home after being given the following explicit directions and diet:

1. Avoid all excitement or irritation like attending receptions, shopping, church work, and politics. If anything happens to annoy you, put it off for a week.
2. You should get an abundance of rest by going to bed early and taking a nap after luncheon.
3. You should have an abundance of fresh air at night, consequently you should sleep with wide open windows or on a sleeping porch.
4. You should take nothing that irritates the nervous system, like tea, coffee, or alcohol. Of course you should not use tobacco in any form.
5. You should eat very little meat. If you are very fond of meat, take a little beef, mutton, or breast of chicken or fresh fish once or twice a week, or at most three times a week.
6. You should drink a great deal of milk or eat things that are prepared with milk, such as milk soup, milk-toasts, etc., also cream and buttermilk are especially good for you.
7. You should avoid beef soup or beef tea or any kind of meat broths.
8. You should eat an abundance of cooked fruits and cooked vegetables, or very ripe raw fruits, or drink fruit juices prepared out of ripe fruits.
9. You may eat eggs, bread, butter, toast, rice, cereals.
10. You should drink an abundance of good drinking-water, or if this is not available you should boil your drinking-water for twenty minutes, or drink distilled water.

We have encountered many cases of exophthalmic goiter which have been extremely unfortunate in their condition following the removal of the thyroid gland, but we have found almost invariably that this has occurred in patients who did so well a short time after recovery from the operation that they returned to their former bad habits of eating and of exposing themselves to excessive physical, mental, and emotional exertion or strain. Since giving each patient printed directions and explaining their importance we have not had these unsatisfactory experiences with our own patients.

11-17-17

A CASE OF FEMORAL HERNIA

Summary: Femoral hernia of one and one-half years' standing; technic of operation —expose the sac, open it, reduce its contents, transfix and doubly ligate, ascertain that the stump retracts into peritoneal cavity, apply skin sutures, make no attempt to close femoral canal; reasons for the superiority of this method over the more complicated ones; results of twenty-five years' experience with this method; cases in which it cannot be used and how to handle them.

October 9, 1916.

History.—The patient, a single woman of fifty-two years, by occupation a trained nurse, was admitted to the hospital October 8, 1916, because of a femoral hernia.

She was operated on in this hospital in 1909 for uterine myoma. Since then she has been well except for the present trouble. For the past five years she has had a lipoma on the back, which has increased in size from that of a walnut to that of a good-sized orange. There is some soreness in the arm and axilla, but otherwise the tumor gives her no trouble except in so far as it annoys her when lying on her back.

About one and one-half years ago she lifted a helpless patient, and following this noticed a lump in the femoral groove. There was some slight pain on the appearance of the lump, but none since. When lying down she has no difficulty in reducing the hernia.

Physical Examination.—The patient is a well-developed and moderately obese woman with good color. Her head and neck are negative. Heart, lungs, and breasts are also negative. Over the angle of the left scapula is a large, soft, lobulated, non-fluctuating, freely movable tumor mass the size of an orange. It is not tender. The abdomen is negative except for a healed low median scar. In the right groin, over the region of the femoral canal and beneath Poupart's ligament, can be felt a small reducible tumor 3 cm. in diameter, which increases in size when the patient stands.

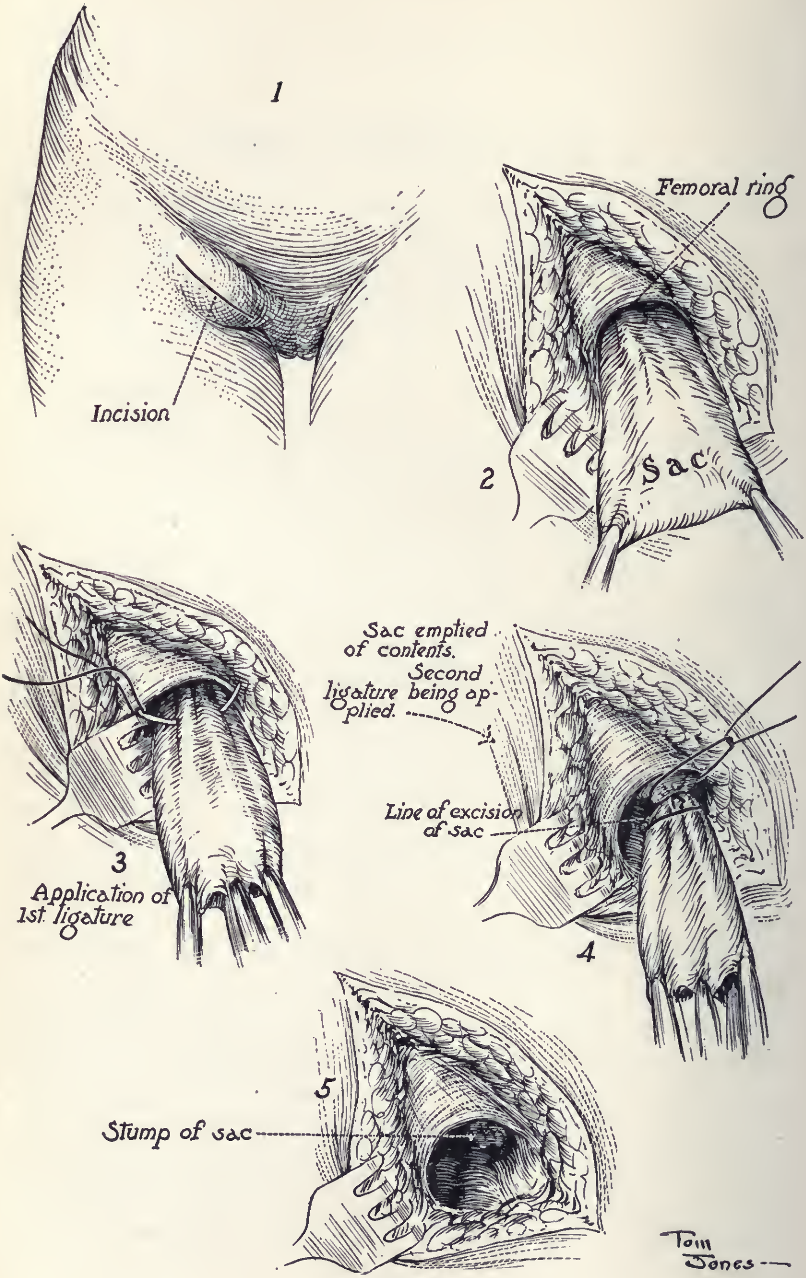
1
Incision
Femoral ring
2
Sac
3
Application of 1st ligature
Sac emptied of contents.
Second ligature being applied.
Line of excision of sac
4
5
Stump of sac
Tom Jones

Fig. 27.

Comments and Operation.—Dr. Ochsner (October 9, 1916): This patient is suffering from a femoral hernia. The operation which we perform for femoral hernia consists in the following steps: We make an oblique incision directly through the prominence caused by the hernia, extending down through the skin and superficial fascia and fat, exposing the hernial sac (Fig. 27, 1 and 2). Then we open the sac, and if any of the contents are adherent we loosen the adhesions. The contents may consist of omentum, intestines, ovary and tube, or the appendix, and occasionally the bladder. The sac is freed entirely, so that its end alone is attached to the edges of the femoral canal. Then the neck of the sac is transfixed by means of a catgut suture, which is tied so that there is no possible chance of slipping (Fig. 27, 3). Then the sac is drawn out as far as it can be and a second ligature is applied as high up as this possibly can be done (Fig. 27, 4). It is doubtful whether this second ligature is necessary, but it is applied as a precaution against the possibility of some portion of the sac escaping from the first ligature. All the loose fat surrounding the hernial sac is removed so that the wound remains perfectly clear. We have now exposed the hernial sac and have opened it, and here we find a very small piece of omentum strongly adherent to its lining. The piece of omentum is not more than 3 cm. in length, but its entire length is adherent. This readily accounts for the fact that the hernia could not be retained comfortably by the use of a truss—it could not be completely reduced. On loosening adhesions like those we have encountered in this case we must guard against traumatism so that we do not injure the tissues unnecessarily. That is an important precaution. Next, we must be careful to start at one angle and proceed systematically until we have loosened all the adhesions. If one attempts to loosen such adhesions in an un-

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Fig. 27.—1, Line of incision made over the hernial bulging parallel to Poupart's ligament. 2, Femoral ring and sac exposed. 3, The sac has been opened and its contents reduced. Holding the sac under tension, the neck of the sac is transfixed and ligated. In 4, with the sac under greater tension, it is transfixed at the highest point that can be reached and a second ligature tied above the first. The portion of the sac distal to the ligature is then excised. In 5 is shown the stump of the sac retracted into the abdomen. No attempt is made to close the femoral ring.

systematic way—that is, beginning at one end and then going to the other and changing about—it requires more time to loosen the adhesions, but by following the other plan of carrying out the dissection from one point and passing around the entire surface it requires but a few moments. One can loosen these adhesions in less than one minute. We take the greatest possible care in retracting the surrounding tissues, so that our ligatures will not include any of these tissues. That is really of great importance, because if our ligature should include any of the tissues belonging to the femoral canal it would not be possible for us to replace the stump within the peritoneal cavity, and that is a fundamental principle upon which the success of this operation must depend.

Our ligature by transfixion has been applied. I am quite as careful in applying this ligature as I was in applying the first one, so as not to include any of the tissues belonging to the femoral canal. In order to apply the ligature high up in the canal the sac is kept in position by means of forceps placed upon it. The edges of the femoral ring are retracted by means of gauze-padded retractors. I remove some little strips of fat which are in the femoral canal so as to leave it entirely free. Then I examine the femoral ring again with my finger, and find that the ligated neck of the sac has retracted into the peritoneal cavity. No attempt is made at closing the femoral canal (Fig. 27, 5); we simply apply the skin sutures with horsehair, and that is all.

A number of methods have been described for the closure of the femoral canal. The most thorough method of closure was described some years ago by a Russian surgeon. This consists in drilling holes through the ramus of the pubes and passing silver wire through these holes and fastening the edge of Poupart's ligament down against this so as to obliterate entirely the femoral canal. At the conclusion of this operation there is absolutely nothing left of the femoral canal. Another method has been described by one of the foreign operators whose name I do not recall. It consists in driving fine steel-wire staples through the edge of Poupart's ligament and into the ramus of the pubes. These two methods are undoubtedly the most thorough and most complete that have been devised, and, according to the author's observations, they are followed by the highest percentage of recurrence. Following some of these more thorough methods of closing the femoral canal there is as high as 20 per cent. or more of recurrences, because in performing these operations the surgeon disturbs the circular opening of the femoral ring, and in order to keep a round opening open all you have to do is to disturb its circular character. It is practically impossible to keep a circular opening open anywhere in the body, because as cicatricial tissue forms it closes such an opening spontaneously. Therefore, if the operation is thorough enough to disturb this circular form of the opening, and especially if the edge of Poupart's ligament is loosened, the operation will produce quite a large percentage of recurrences.

The method which has been practised by Coley and Bull and which consists in the application of a circular suture to the surface of the femoral opening, has been very satisfactory because it does not disturb the shape of the opening. There is a fundamental principle in surgery according to which all useless things that are done in connection with operative treatment must at the same time be harmless. Unless useless things are harmless they should not be done. Now these other operations that I have described are useless, but not harmless. For that reason they are followed by a large number of recurrences. We have used the method of operating which we have employed in the patient before you in a very large number of femoral hernias during a period of twenty-five years. Some years ago I wrote letters to all the patients whose femoral hernias we had operated on during the fifteen years preceding, and among all those from whom we had answers there was not a single recurrence. The reason is that all these operations were performed by the method you saw illustrated in this case. There is no doubt in my mind that this case will follow the same rule, and that this femoral ring will close immediately and firmly.

This method cannot be employed in the very limited number of cases of femoral hernia in which the condition is due to a direct traumatism which has torn the femoral ring and has changed it from a circular into an oblong or a triangular opening. In these cases we have freshened the edges and restored the opening as nearly as possible to a circular form by the use of chromic catgut sutures.

The same is true in cases operated for the relief of strangulated femoral hernia in which it has been necessary to cut the ring in order to replace the intestine in the abdominal cavity. In these cases we have also restored the ring as nearly as possible to the circular form, and our results have been equally satisfactory.

This method was described and recommended many years ago by Prof. Socin, of Basel, but I have never seen his article quoted. I came across his description of the operation accidentally while searching the literature after we had employed the method in many cases. So far as I know he was the first surgeon to use the method.

11-28-17

HERNIAS IN CHILDREN

Clinical Talk with Demonstration of the Operative Treatment of an Inguinal Hernia in the Case of a Child Eleven Months of Age

Summary: Large inguinal hernia in a child of eleven months which cannot be kept from protruding by non-operative methods and which occasionally is difficult to reduce; perfect results from herniotomy in children, but the operation unnecessary and therefore not advisable in more than 7 per cent. of the cases; when to operate—six conditions which warrant interference; the non-operative management; the technic of inguinal herniotomy in children—importance of avoiding manipulation of the cord; the dressings and after-treatment; general conclusions.

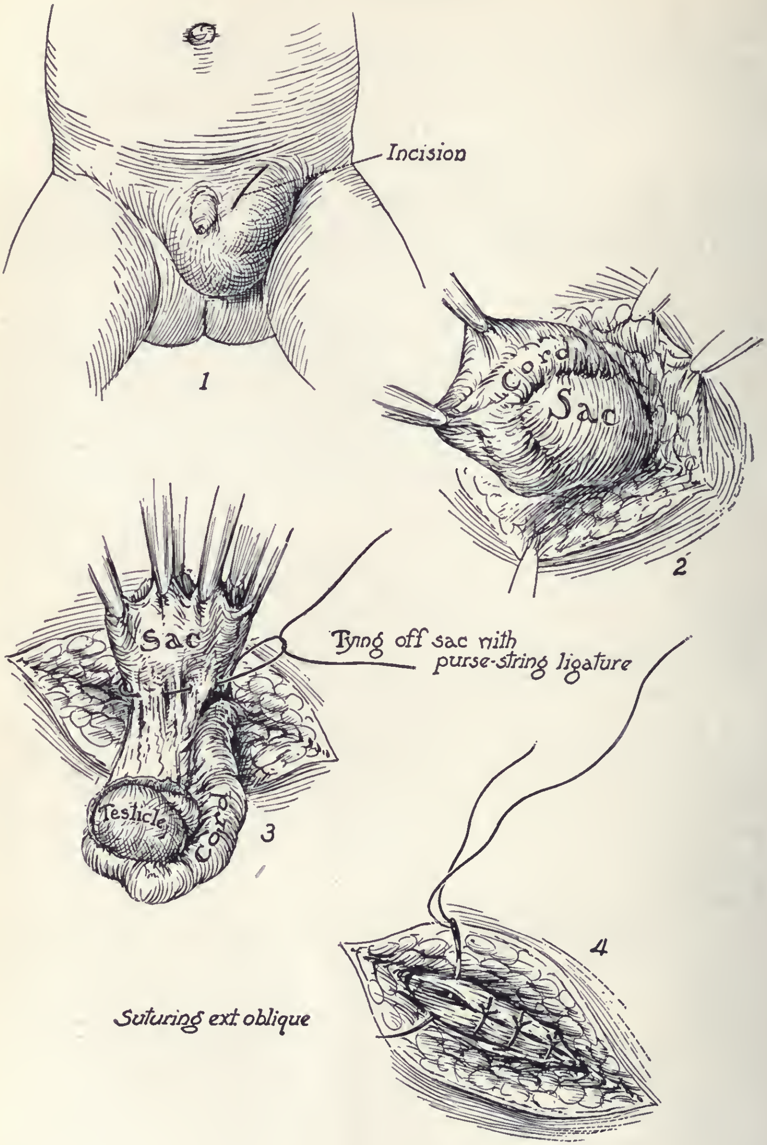
September 11, 1916.

History.—The patient, a male child of eleven months, was admitted to the hospital September 10, 1916, because of a left-sided inguinal hernia.

The father is living, but is at present in this hospital, having been operated on September 8th for intestinal obstruction due to postoperative adhesions. The mother is living and well. There is no history of tuberculosis or malignancy in the family. The patient had a diarrhea for two days in June. He has always been healthy, with the exception of the trouble for which he is brought to the hospital.

Two weeks after birth the mother noticed a swelling in the left inguinal region. It was just perceptible at first, but has gradually increased in size until now the whole left side of the scrotum is filled. The baby is not fretful and eats and sleeps well. The bowels are regular. He also has a phimosis.

Physical Examination.—The patient is a well-developed and well-nourished baby. Head, neck, chest, heart, lungs, and abdomen are negative. The right groin and right testicle are negative. Arising from the external inguinal ring on the left side and filling the left scrotum is a tense, spindle-shaped mass (Fig. 28, 1), which, when the patient is placed in the inverted



Tom Jones —

Fig. 28.—In 1 is shown the large hernial bulging and the site of the incision. In 2 and 3 the method of exposing and handling the sac is shown. Note the remnant of sac representing the tunica vaginalis about the testicle. In 4 is shown the simple closure of the incision in the external oblique—all the sutures that are necessary as a rule.

position, can be easily reduced with the fingers. Upon coughing or crying the bulging protrudes even when the child is in the inverted position. The external ring admits the tip of the first finger. It has been quite impossible to keep the hernia from protruding, and when it has been forced out to a marked extent its reduction has been difficult, so that the mother has been in constant fear of strangulation. There is a marked phimosis, so that the glans cannot be seen.

Comments.—DR. OCHSNER (Sept. 11, 1916): About twenty years ago I had occasion to operate upon several strangulated hernias in children, and the results were so satisfactory that it seemed to me as though it would be proper to operate on all congenital hernias in children, because in a few weeks the children upon whom I operated were well without having been exposed to very much danger. This same view is taken at the present time by many surgeons. Harold Stiles, of Edinburgh, surgeon to the Children's Hospital, has written a great deal upon this subject, and the argument he makes is that children recover in a week or two from hernia operations, that they are not harmed in any way, and that in the last 100 cases he had an infection in only 1 case. Consequently the annoyance which the child has from the hernia during the time it is growing up, and the danger of strangulation and the harm that comes to the child from being unable to play like other children will be eliminated by operating upon them. That strikes one naturally as a most reasonable argument if one looks at it simply from an operative standpoint.

In looking up the literature I found that the subject had been studied very carefully by Malgaigne about sixty years ago. He had the children examined when they first went to school. He had them again examined when they were eighteen or nineteen years of age and ready to join the army. The result of the examination was quite striking. He found that 73 per cent. of those who had hernia in infancy were free from hernia when they had grown up, and that without any treatment at all. The ring simply closed without any surgical or medical care. Seventy-three per cent. had gotten perfectly well between the time of the first examination and the time of their entering the army. This seemed to indicate that the proposed plan of operating on every child with hernia could not be looked upon as reasonable when 73 per cent. got well spontaneously. That led us to make further observations, and we found that in our own cases over 90 per cent. recovered spontaneously without operation, provided the cause of the hernia was removed. It happened about the same time that I was called to see a child suffering from a strangulated hernia. The usual attempts at reducing this hernia failed, so I took the child in my carriage to the hospital with a view to operating. I had the father hold the child on his lap while we drove to the hospital, and when we arrived the strangulated hernia had been spontaneously reduced, so I placed the child in bed with the foot of the bed elevated for the purpose of preventing a recurrence, and in three weeks the hernia was healed spontaneously and has remained healed ever since, so that that observation was added to what I had learned from the study of Malgaigne's work.

Shortly after that a child was brought to me that was suffering from a severe phimosis and also from an inguinal hernia, and I thought that while the child was recovering from the phimosis operation it might as well recover also from a herniotomy, so I proposed to the parents that we do a herniotomy at the same time. This they refused, and to my surprise when the child was well from the phimosis operation the hernial ring had closed. At that time I was consulting surgeon to the Children's Hospital, and had an opportunity of seeing a good many cases of hernia in children, and I have had since that time an opportunity of following up a large number of these cases. In that way I have had an opportunity of determining what class of cases require operation.

In our study of the literature of these cases we found that Coley and Bull had observed 15,000 cases of hernia in children in the Hospital for Ruptured and Crippled in New York. They found it necessary to operate in about 5 per cent. The rest recovered spontaneously or disappeared from treatment. In our own observation the same proportion holds good, so that we believe that only patients suffering from the following six conditions require surgical treatment:

(1) Cases that have a congenital deformity in which the muscles congenitally are not developed properly, a class of cases in which when you look at the abdomen you observe three distinct points of prominence, a condition which is known by the French surgeons as the "abdomen of three hills." In this class there is a marked abnormality in the attachment of the internal oblique and transversalis muscles to Poupart's ligament, a condition which Dr. Ferguson pointed out as being practically always present in adults suffering from hernia. When this condition is marked the hernia will not recover spontaneously.

(2) Cases of the class that we have to deal with in our patient today, where every day or so the hernia goes down and the parents find it difficult to reduce it. Hernias which cannot be retained by any method that may be employed and which show a tendency to strangulation. In the case before us the hernia protrudes even when the child is in the Trendelenburg position and it is difficult to prevent its protrusion with the finger on the inguinal canal.

(3) Cases in which a strand of omentum has become attached to the hernial sac or in which there have been adhesions to one of the intestines, usually the cecum, so that, although the hernia is not strangulated, it cannot be reduced because of this adhesion.

(4) Cases in which the hernial opening is kept permanently open because of the presence of a hydrocele of the cord which slips in and out of the inguinal canal and prevents this canal from closing, and so, in turn, permits the hernia to protrude.

(5) Cases with undescended testicle with an inguinal canal that is so widely open that its spontaneous closure seems quite improbable.

(6) The last variety of hernia in children which requires an operation is the variety in which there is an irreducible strangulation.

These classes constitute about 7 per cent. of all cases of hernia in children. Now, then, if we should operate upon every case of hernia in children we would have to operate upon 100 children in order to cure 7. Of course, that would not be quite fair to the 93, but would be fair enough to the 7 cases; that is, 7 would probably have to be operated sooner or later because they have deformities which make a spontaneous cure of the hernia impossible.

Now regarding the difference between the 73 per cent. of fifty years ago and the 93 per cent. of today, I will say this, that those patients who recovered in the series that Malgaigne reports were not treated at all. The cause of the hernia was not removed. Now in our cases we teach the parents to take care of these children with hernias so as to guard against abnormal intra-abdominal pressure. We give them laxatives to prevent constipation, we operate for phimosis so as to relieve the obstruction to the passage of the urine, we eliminate articles of food that cause gaseous distention of the intestines, and, above all, we place the child in bed with the foot of the bed elevated about 30 degrees, so that the mesentery has a chance to retract. Usually it requires from three to six weeks for hernia to close. In many cases it is not necessary to keep the children in bed day and night, but putting them to bed at 5 o'clock in the evening after an early supper and permitting them to be up during the daytime.

We have encountered some children who could not be kept confined to their beds in the Trendelenburg position because they would move about and change their heads to the foot of the bed, and in that way interfere with the plan of treatment. In these cases we have continued the plan of permitting them to be up during the daytime and placing them in the desired position at night. When this form of treatment has failed, we have applied rubber adhesive straps to both legs, and have placed the patients in bed on their backs and suspended the legs by means of weights and pulleys. This position seems to be even more favorable for a rapid closure of the inguinal canal than the simple Trendelenburg position in bed, but it is, of course, less comfortable. For this reason we have not employed it in patients who were willing to maintain the Trendelenburg position without this aid.

Then we have found quite a series of cases in which the hernia healed spontaneously every summer and opened up every winter, because the children got coughs, and in coughing opened the hernias. In this class of cases we advise the parents to give the children cold sponge-baths winter and summer, and have them wear woolen underclothing, sleep between woolen blankets, and keep the windows wide open, so that they do not get coughs and so avoid recurrence of the hernias. As a result of this treatment 93 per cent. of our cases get well without an operation, and only those belonging among the six classes I have mentioned require an operation.

An argument in favor of operating upon hernias in children has been made according to which it is supposed that by operating upon children one may avoid operations upon the adult which would otherwise be inevitable. It seems, however, that this argument cannot be supported by clinical observation, because the proportion of patients who have spontaneously recovered from hernias during childhood, or before the twelfth year of age, who have later on acquired hernia is exceedingly small. In our own clinic we are not in a position to give the exact figures showing the percentage of such cases, but I am convinced that the number has been so small that it need not be considered.

OPERATION

Yesterday when I tried to reduce this hernia I did not succeed at first, although the mother said that it would go back, and later reduction was possible.

In operating upon these small patients the incision is made precisely as in the adult, down through the aponeurosis of the external oblique muscle so that the entire inguinal canal is exposed. From this point on, however, it is of the greatest importance to exercise unusual care in order that the delicate tissues of the cord may not be permanently injured. None of the tissues of the cord should be caught in the bite of the forceps. In case of bleeding, the end of the vessel should be caught with the greatest possible care, and a fine ligature should be applied immediately in order that the tissues may not be pulled upon by the forceps.

I am separating the cord very carefully because it is very important that I should not injure any of its structures. This can be done by picking up this peritoneal tissue step by step until

I have the entire sac free, and then lifting up this sac so that the neck of the sac is virtually exposed, and when this has been accomplished the tissues of the cord are pushed out of the way and the sac is ligated quite a bit higher, so that when the superfluous portion of the sac is cut away the stump will retract into the peritoneal cavity (Fig. 28, 2 and 3). The portion of the sac which lies about the testicle I will not disturb, because it will take the place of the tunica vaginalis. In fact, it is the tunica vaginalis, only its embryologic communication with the peritoneal cavity failed to be obliterated in the ordinary manner. The testicle, which has been drawn out during this operation, will be replaced in the scrotum. We ligate everything with the greatest care because we wish to have this wound absolutely dry. Now, you see, we have not interfered in any way with the cord, and so far we have not interfered with the inguinal canal.

Now we have all the bleeding vessels connected with the cord ligated, as well as all the little vessels that we cut in making our original wound. This is done in order to keep the wound absolutely dry.

The next question is that regarding the closure of the inguinal canal. The sac having been retracted, I find that the inguinal canal here is small enough to close spontaneously, and consequently I shall not disturb it in the least. I follow the method which Mr. William Anderson, of St. Thomas' Hospital, London, introduced thirty years ago for the radical cure of ordinary inguinal hernia in the adult, which consists simply in removing the sac within the inguinal ring, ligating it, and dropping the stump back and leaving the canal to close spontaneously. I simply close the aponeurosis of the external oblique abdominal muscle and the deep tissues of the outer wound with care and then suture the skin (Fig. 28, 4). In cases in which the canal will not close enough to practically ensure a spontaneous cure we make use of the method employed by Harold Stiles, of placing one or two sutures to include the internal oblique and transversalis muscles on the inner and Poupart's ligament on the outer side, which in this case does not seem to be necessary. In no case do we make use of the Bassini operation because of the fear that by manipulating the cord in the way required in that operation we might cause a permanent injury to that structure and resultant atrophy of the testicle. In the cases in which there is a very marked congenital defect, so that the inner and outer surfaces of the canal do not meet, we make use of the Ferguson-Andrews operation, that is, we leave the cord in the bottom of the groove, and suture the internal oblique and transversalis to the shelf of Poupart's ligament, and then imbricate the aponeurosis of the external oblique so as to double it, according to the method introduced by E. Wyllys Andrews. That does not compress the cord and still makes a very perfect closure, but is ordinarily not necessary.

This patient has a very bad phimosis. We will loosen up the adhesions of this prepuce and, if it seems wise, make a circumcision. We find that after tearing the adhesions between foreskin and glans the foreskin is readily retracted. Therefore circumcision will not be necessary. In cases like the one before us, in which it seems that the condition will not require it, we do not make a circumcision, but simply loosen the adhesions. The operative wounds and surrounding skin are now covered with vaselin so that they will not be soiled with the urine, and dressings are applied. The baby's hands are tied so that he will not be able to disturb the wound.

A number of methods have been employed for dressing these patients. The one introduced by Harold Stiles, in the Children's Hospital in Edinburg, is probably the best. The little patient is strapped upon a frame similar to the Bradford frame that is so well-known in this country, and the wound is left entirely uncovered, which enables the nurse to keep the child from soiling the wound. It is by following this plan of dressing that Dr. Stiles has obtained most remarkable results. In an institution in which there are constantly many of these patients this is undoubtedly the best way. In the average hospital, however, the parents of the patients are likely to object to this method, which seems unusual to them, but which, in reality, is not at all burdensome to the patient. If this plan cannot be employed, a vaselin dressing which will protect the wound against soiling with urine is probably the best to be employed.

Conclusions.—1. The development of hernias in children is favored by: (*a*) Faulty development of the abdominal wall; (*b*) insufficient strength in the tissues involved in closing the umbilical, inguinal, or femoral openings; (*c*) abnormal intra-abdominal pressure; (*d*) patency of the tunica vaginalis.

2. The causes *a* and *b* are frequently inherited.

3. The abnormal intra-abdominal pressure is due: (*a*) To gaseous distention resulting from improper feeding; (*b*) to the exertion necessary to evacuate the bladder on account of obstruction due to phimosis; (*c*) to severe, long-continued coughs; (*d*) to vomiting; (*e*) rarely to traumatism or overexertion.

4. Approximately 95 per cent. of all cases of hernia in children will heal spontaneously if the abnormal intra-abdominal pressure is relieved and the hernial sac is kept empty.

5. This can be accomplished by means of trusses, or much more rapidly in inguinal and femoral hernia by placing the child in bed with the foot of the bed elevated; the time required usually does not exceed six weeks, and in most cases the hernia will heal upon relieving the abnormal intra-abdominal pressure and simply placing the child in bed with foot of bed elevated from 6 P. M. each night to 8 A. M. the following morning for several months.

6. Children with a tendency to the formation of hernia should be guarded against developing coughs.

7. The diet should be given at regular times and chosen with a view to avoiding gaseous distention.

8. Constipation should be entirely prevented.

9. In case of boys phimosis should be relieved, if present, by operation.

10. Badly nourished and badly cared for children of the poor should be treated in hospitals, being placed in bed in the Trendelenburg position, the cause of increased intra-abdominal pressure being removed at the same time by proper diet and treatment.

11. Operation is indicated: (*a*) In strangulated hernia; (*b*) in irreducible hernia due to adhesions; (*c*) in case the opening is unusually large in a free hernia, especially if the condition is hereditary; (*d*) in reducible hydrocele; (*e*) in cases with unde-

scended testicle unless they show a tendency toward spontaneous cure.

12. Except in class *c* the operation should consist simply in carefully dissecting out the sac, or in certain cases of congenital hernia, the neck of the sac, ligating it within the abdominal cavity, cutting away the sac and permitting the stump to retract within the abdominal cavity, and closing the skin wound.

13. In class *c* the Ferguson-Andrews operation is indicated.

14. In class *e* the Bevan-Ferguson-Andrews operation is indicated.

15. The recumbent position, with the foot of the bed elevated, is of very great importance in the after-treatment of operative cases as well as in the non-operative treatment of hernias in children.

16. In young children who will not remain in bed with the foot of the bed elevated this position can usually be maintained by applying rubber adhesive straps to both lower extremities and having these held in a vertical position by means of weights and pulleys.

17. If the child cannot be kept in this position, a well-fitting truss should be worn night and day until there has been no protrusion for at least six months; at the same time the necessary precautions must be constantly taken to guard against abnormal intra-abdominal pressure from any cause.

CLINIC OF DR. E. WYLLYS ANDREWS

11-28-1

Mercy Hospital

FRACTURE OF THE PATELLA TREATED BY OPEN OPERATION

Summary: Repair of the ruptured joint capsule is essential and curative—bony union an incident and not essential; importance of early mobilization; technic of operation—absolute asepsis imperative; period of disability shortened and late results much improved over those obtained by older methods.

In our clinic the old term "wiring the patella" has no meaning. We have not in the past ten years drilled the fragments or used wires to hold the bone itself. We regard the operation as a closure of a rent in the anterior half of the capsular ligament to be repaired from side to side with many stitches, and the patella only as a sesamoid bone in the course of a tendon whose repair takes care of itself. It is true that we get bony union when we do this repair work, but this is an incident and not an essential, whereas repairing the ruptured joint capsule is essential and curative.

So far many surgeons will agree with me, but I find many are skeptical or hostile when I speak of the after-treatment I employ. I advise and practice early active and passive movements of the knee-joint after operative reduction. I mean by this that I use no cast or support, and bend the knee on the operating table the next day and all subsequent days until recovery. I also use active or voluntary leg movements involving the broken bone. After the skin wound is well healed, in from one to two weeks, I remove all dressings, have the knee massaged and bent a little daily, and cause the patient to flex and straighten his knee by his own muscles. In one clinic before the Chicago Surgical Society I showed a man three weeks after operation who could raise his leg and foot off the table and extend the knee entirely by the function of the united capsule and patella. I found none of my colleagues who had anything but disapproval for this revolutionary idea, and the discussion developed the information that most of them kept these cases from five to eight weeks in casts as a routine after operation.

In defense I will say that with proper suturing the capsule is enormously strong, stronger the day of the operation than at any subsequent time until tissue repair is under way. If a suture will not stand light passive motion of the knee, much less will it stand the spastic pull of the quadriceps, which occurs as well in the cast as without it. On the other hand, we believe that repair goes on far more rapidly and certainly in parts which are daily moved and massaged. Trophic changes are noticeably absent with this method and are unmistakably present and objectionable in the old method. Everything we know about injuries to other joints goes to prove that the repair both of bone and ligament is greatly hastened and assisted by the improved circulation which movement and massage affords.

Finally, when a patient is allowed to use his limb after complete union by this method, no limitation or disability remains. Can we say as much for the fixation management? Our experience with long fixation, either after operative or non-cutting management, is that months or years of partial stiffness await the patient after the final removal of all appliances.

I will now illustrate the mode of operating which gives us such confidence after the repair. I sometimes speak of these operations as "laparotomies on the knee-joint." The method is essentially an American contribution to surgery and owes much to Dr. Joseph Blake, of New York, who early called attention to the importance of closing the torn lateral ligaments to support the bone. Every fracture with separation shows certain pathology outside the bone. A wide fissure extends from condyle to condyle about half the circumference of the joint. The broken bone has nothing to do with causing this tearing of the capsule. The capsule is not torn because the bone gave way, but the bone is broken because it lay across the line of torn tendon and ligament. The patella neither weakens nor strengthens the knee. It is not there to give strength, but leverage. It is a pulley wheel only, but the rope that has the strength is the quadriceps tendon and ligament.

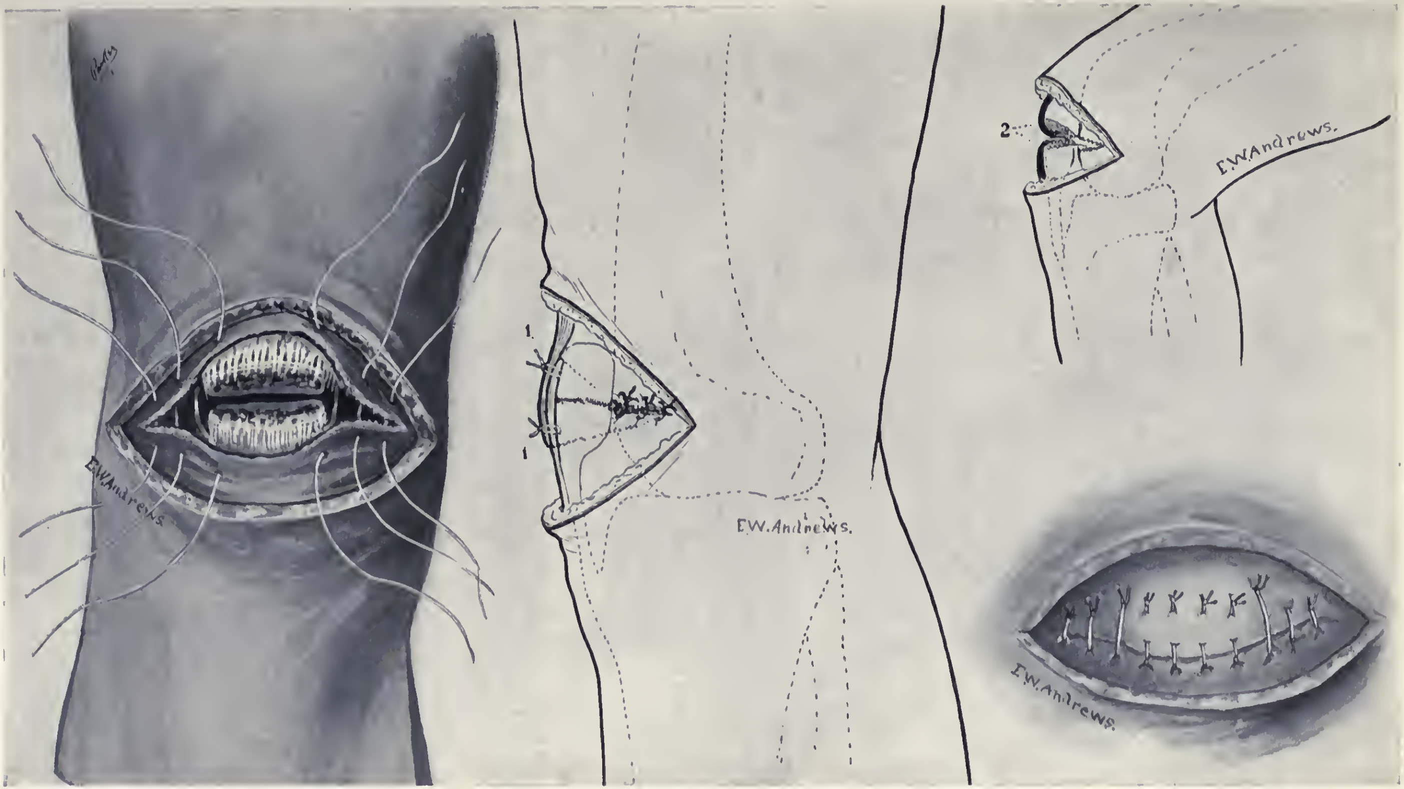


Fig. 29.—Open incision showing tear in lateral ligaments: 1, Sutures in place and overlapping of anterior fascia; 2, fringes of periosteum and ligament lying between broken bones.

The patella, by raising this cord away from the condyle groove, increases the radius of this pulley wheel about 25 per cent. When the tear occasionally occurs just above or below the patella we have surgically about the same injury—a torn capsule—only without associated fracture.

The torn ligament presents each side of the patella a gaping V-shaped opening, leading directly into the joint, which is usually full of blood. After careful cleansing of the synovial cavity, preferably by a jet of warm sterile salt solution without sponges, fingers, or instruments, we begin closing these V-shaped tears at their apices, that is, at each condyle. Durable catgut or kangaroo tendon of good size is required. Often I have been able with a separate light stitch to repair the torn synovia as far as the patella border, but never successfully across its inner surface. As we approach the middle line with interrupted sutures from each side we soon have the edges of the bone in actual contact, and now we observe that the fragments are often inverted and have to be drawn forward and cleared of a sheath of ligamentous tissue and torn periosteum which cover their broken ends. Until this is done the fractured ends will not come into bony contact. This leaves a fringe or flap of some size hanging from each fragment. Instead of cutting these away, I use them overlapped and sutured over the front of the bone to assist repair, and they add greatly to the strength of the suture. It is as if there were a band of ligament from the quadriceps tendon above to the ligamentum patellæ below, transmitting the pull of the powerful quadriceps partly through ligament and not wholly through bone. The last lateral sutures—the pair adjacent to the bone on each side—should be placed very carefully and be double or of large size. Just as they are drawn, the cartilage margins and whole surface of the fragment should be accurately adjusted to each other. When care is taken and these two stitches tightly knotted, the fragments will be immovably locked together and the crevice between them almost invisible.

The overlapping of the anterior flaps, the periosteoligamentous flaps I have just described, can now be done, and I advocate also a circular loop of large kangaroo tendon around the entire patella, passing through the tendon above and ligament below.

We have now by the adding of one stitch to another built up an enormously strong line of repair. I believe we have demonstrated by our active and passive movements—postoperative—that this is ample to stand all reasonable passive motion and light active motion, say to the degree of lifting the weight of the foot and leg. I know absolutely that this is true just after operation. Whether there is a period after stitch absorption and before complete tissue repair when rupture of our union might occur I cannot determine. I have seen but one failure due to an unruly patient disobeying orders and walking in five weeks. He fell down while intoxicated and had his union give way. On the other hand, I have seen this occur after a much longer time when the bone had been merely wired together—in one case after fifteen or sixteen weeks.

One advantage of careful closure of the capsule separately from the skin is that it makes it almost immune from infection. The only infections I have ever seen with the method were slight stitch sinuses near the surface with no sign of arthritis or synovitis. Like the peritoneum, the synovial surfaces will resist and repel invasion of septic material if given a chance to seal themselves aseptically. I have never in a large series of cases seen any hydrorrhea or synovial flow after operation nor any floating patella or usual signs of distention or gonitis.

This is an operation only for the careful, scrupulous enthusiasts in bone surgery. Sponges, instruments, and gloved hands should not touch either the wound surfaces or any needle, thread, or knife-blade. The technic of handling all instruments in passage with forceps and of tying all knots without touching the fingers to thread or needle is easily acquired in any clinic. It may be seen in its perfection in many places where bone surgery is being taught.

Given these precautions, the operative treatment of fractured patella is considerably surer, quicker, and easier for the patient than the non-operative, and almost equally safe. It gives a far more perfect result than was formerly obtained, and fewer cases of refracture and permanent lameness.

THREE CASES OF PLASTIC SURGERY

Summary: Case I: Cicatrix binding arm to side following a severe burn; technic of division of "webs," either cicatricial or congenital, which is necessary in order to prevent recurrence. Cases II and III: Illustrating the advantages of flap methods and abdominal skin pockets over Thiersch grafts for the repair of extensive cutaneous defects on the hands and the technic involved.

CASE I.—OPERATION FOR LARGE WEB BINDING ARM TO THORAX

THIS patient, I. M., age nine years, had a severe burn five years ago extending from the shoulder to the thigh and inner side of the left arm. The resulting cicatrix is dense and deeply adherent in its lower half, forming a keloid-like mass across the hip

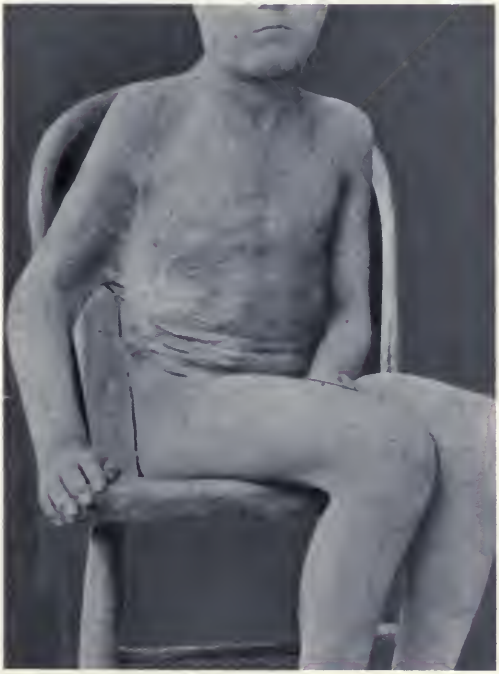


Fig. 30.—Large web of cicatrix binding arm to chest wall.

and waist line. Above this level the scar-tissue has been allowed to form extensive adhesions between the trunk and inner aspect of the arm as far as the elbow, binding the limb to the side. In spite of all efforts at passive motion these have persisted, but now have been stretched into a triangular web or fin allowing the arm to be abducted a few degrees from the body line. The membrane is thin—not over 1 cm.—but limits the use of the arm 75 per cent. and prevents the use of ordinary clothing (Figs. 30 and 31).

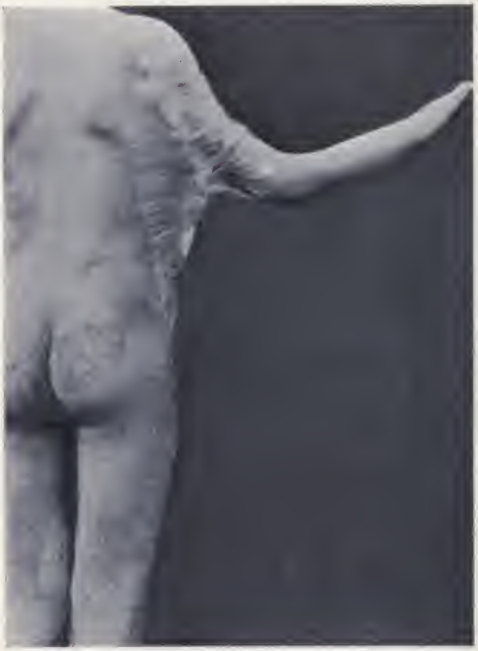


Fig. 31.—Posterior view of Fig. 30, showing limitation of motion.

The problem here is the same one presented by web fingers and toes, but on a larger scale, viz., to so divide the membrane that its healing will not reproduce the bridle of scar-tissue as bad as before. Exactly the same trick of technic serves us here as in similar webs in any part of the body. This is, in brief, to secure a round, healed perforation at the upper angle of the web, and later divide the whole band. The photograph shows how well this succeeded, the arm coming easily to the horizontal line after complete healing (Fig. 32). In two months this boy could raise his arm almost to a vertical position.

The round foramen should be made at the first operation at the highest point to be released. Time enough is then allowed for its edges to become smoothly cicatrized. The rest of the web can be cut at a later stage and the triangle will then have little tendency to bridge across. When this is not done, a very obstinate tendency is present during the healing to produce the web from the corner or angle outward. In spite of all passive motion and forced extension this keloid-like action persists, sometimes entirely reproducing the false bands that were cut, and also making the healing slower in proportion to the degree of traction kept up.

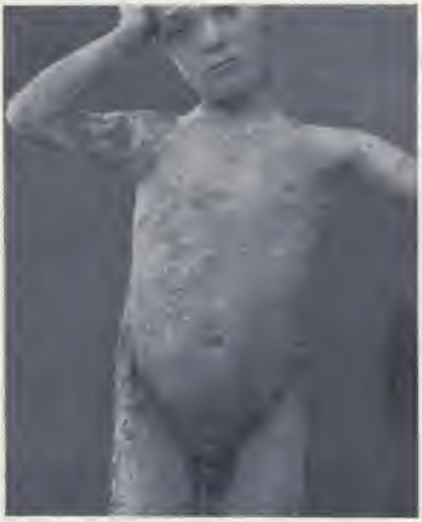


Fig. 32.—Result of operation for removing cicatricial web.

With the preliminary foramen no tension at all is met in the wound surfaces. We have two spaces instead of one long one to heal. The upper angle, having been fixed by the preliminary hole, is not distorted or in any way an obstacle to repair.

CASES II AND III.—FLAP METHODS AND ABDOMINAL SKIN POCKETS VERSUS THIERSCH GRAFTS AFTER HAND INJURIES

Two cases are here shown in which we have chosen to employ large flaps of the abdominal wall to cover defects of the hand:

Case I.—Mrs. H. R. had lost all the dorsal skin of the hand and had tendon adhesions so that all extensor power in the fingers was abolished. The method here used involved three distinct steps all equally important:

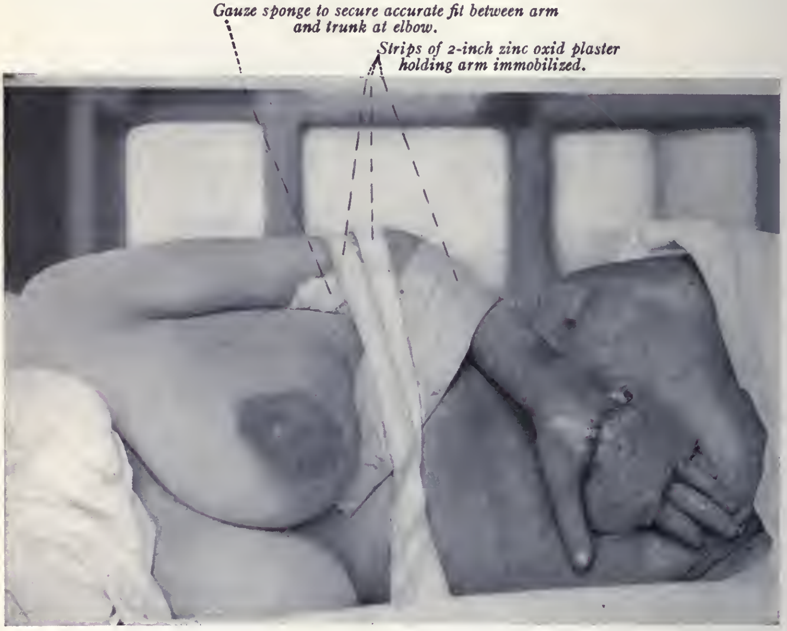

Gauze sponge to secure accurate fit between arm and trunk at elbow.
Strips of 2-inch zinc oxid plaster holding arm immobilized.

Fig. 33.—Patient is lying on her right side. First stage completed. Operation done September 7, 1915. Double pedicled flap is sewed to skin edges at fingers and near wrist with interrupted silkworm-gut stitches.

(*a*) Dissection of the extensor tendons from their sheaths along the dorsum where they had become immovably adherent.

(*b*) The formation of a new bed for these tendons by underlaying them with a free transplant of fascia lata. This was obtained with about ½ cm. of adherent adipose tissue and was laid fatty side outward beneath the tendons. At this stage of the operation the fingers were bound to be fairly movable.

(*c*) The exposed hand and tendons were now covered by a flap of skin and fat obtained from the abdominal wall by forming a pocket of the right size and shape neatly to cover the defect. As the fingers were not denuded, they were allowed to project beyond the pocket of skin, which thus became a sort of band or bridge fed by its end vessels. The hand was thrust through the pocket in the skin, and the underlying muscle and raw surface protected by a sheet of thin rubber or gutta-percha.

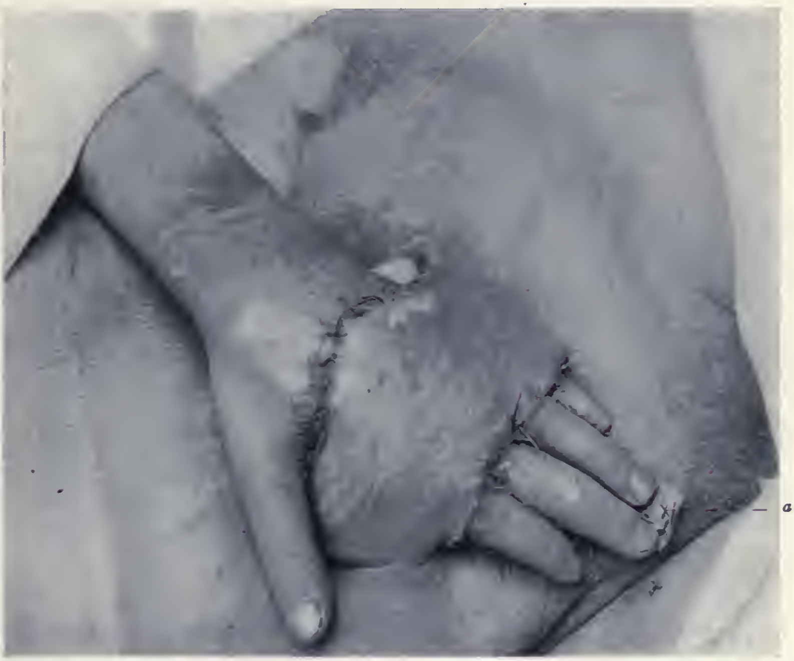


Fig. 34.—First stage completed. (Detail.) In upper left-hand corner we see the adhesive tape (Z. O. plaster) binding elbow and upper part of forearm to abdomen and trunk. Operation done on September 7, 1915. *a*, Gutta-percha tissue drain beneath hand.

Care should be taken that the hand lies in an easy position without traction and that the flap has good arterial supply. This is well attained by making its base on one side cover the distribution of the superficial epigastric artery which runs upward and inward from about the middle of Poupart's ligament.

It happens also that this location permits the arm, forearm, wrist, and hand to lie in an easy position of slight flexion (Figs. 33 and 34).

To secure good union the edges of the prepared area on the hand must now be sutured accurately to the borders of the flap. Here care must be taken not to create tension or pressure. With the elbow and arm held by plaster or starch dressings all this can be avoided, and primary union will be advanced enough in ten or fifteen days so that the ends of the flap can be severed and its circulation maintained from its newly united margins. I have lost such flaps from cutting them loose after seven days, and have had one live when divided on the eighth day. Experience leads

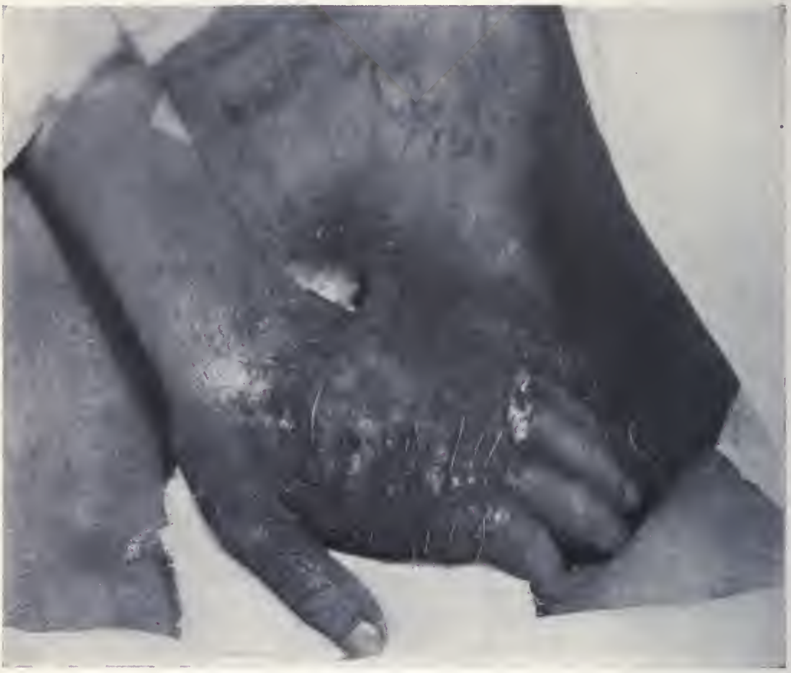


Fig. 35.—Second stage completed. This operation, done September 21, 1915, consisted in dividing the pedicle at the radial side of the hand. Note bismuth subiodid powder causes the black, dirty appearance and hides the knots of the interrupted silkworm-gut sutures tied with a surgeon's knot—*i. e.*, a double or friction knot.

me to regard ten days as a minimum safe time. Occasionally I have divided only one end and left it in position for a few days (Fig. 35). When the flap is entirely severed from its two bases its cut margins are also stitched to the margins of the hand after refreshing the edges of both.

The gap in the abdominal skin can usually be drawn together at the same sitting by strong sutures. To make this easy its margins may be undermined a little.

Case II.—This is of similar history, the back of the hand having been denuded by a crushing injury some months ago. The tendons are not adherent in this case, but the large dense cicatrix which will be left even with Thiersch grafting is very undesirable in manual labor. A soft and movable skin cover can only be obtained by a flap transplant. Here, the defect being upon the back of the hand, the position is an easy and natural one when it is placed in a skin pocket formed by two parallel cuts about 10 cm. apart (Fig. 36).

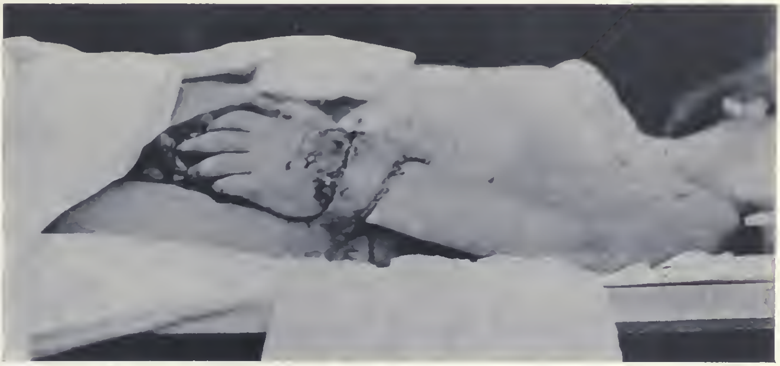


Fig. 36.—Defect on back of hand and wrist covered by skin-flaps.

A different problem presents itself when the palmar surface is to be grafted. Either the hand or the flap must be inverted to get the proper apposition. To invert the hand so as to make its palm face outward we may best place it on the outer side of the thigh. Here it lies fairly comfortable in a position of inward rotation covered by the skin-flap as on the abdominal wall. To invert the flap itself we must leave it attached only at one end, turn it completely over so as to face outward, and stitch its free end and lateral borders to the palmar defect. This can be done either on the abdomen or thigh. In a recent case we lost one such flap by sloughing, the hand having been placed in a skin pocket on the outer side of the thigh. This is more likely to occur there than on the abdomen, probably because the tension is greater and its vascular supply less abundant.

A CONTRIBUTION BY DR. L. L. McARTHUR

AN IMPROVEMENT IN THE TECHNIC OF GASTRIC SURGERY

Summary: Indications for the introduction of liquids into the intestinal tract through biliary fistulæ; value of the procedure in shock and in other postoperative complications; complete control of vicious cycle; technic—hot, slightly hypotonic solutions the best; acid solutions not tolerated; experience demonstrates this to be a valuable conservative detail, not a surgical insult.

Two years ago I chanced to have in my service almost at the same time three consecutive cases of stomach surgery associated with such frank bile-tract disease as to require simultaneous interference. The close sequence of these cases and their strikingly smooth convalescence, with freedom from those annoying postoperative sequelæ—vomiting, vicious circle, shock, anuria, etc.—excited the comment of both my assistants, the nurses, and myself. On analyzing the postoperative histories of these cases, it was noted that in quite our routine way we had utilized the existing biliary fistulæ to meet some of the several indications arising during their convalescence.

For the benefit of those present who may be unfamiliar with the previous suggestions of the writer, amplified and improved as they have been by Matas, the Mayos, Clermont, Von Haberer, and others, I may digress to the extent of stating that through existing biliary fistulæ it has been shown to be easily feasible to introduce distal to the stomach into the upper intestinal tract any quantity of any appropriate liquid, often with surprisingly beneficial results. Thus, Dr. Wm. Mayo demonstrated that the postoperative vomiting so often complicating bile-tract surgery could be relieved and the stomach washed out by the instillation of a liter or two of hypotonic salt solution. The writer reported several cases of complete anuria incident to a cholemic nephritis restored to active secretion by the same procedure. Matas, after having saved 3 such cases complicating common duct stone with chronic jaundice, became so convinced of the great value of the procedure that, under gas anesthesia, he purposely created the first therapeutic biliary fistula in the *normal* gall-bladder. A young boy suffered from a complete anuria complicating a recent septic peritonitis. Through this fistula he immediately instilled large quantities of hot Vichy Celestins into the duodenum, with the prompt return of renal secretion and a restoration to health after other methods had failed.

Whatever may be the mechanism of shock, most authorities are agreed that there is a diminished amount of blood in the peripheral vessels with a corresponding increase in, engorgement of, or stasis in the splanchnic system. For that condition to which we are accustomed to apply this term "shock" I have found no procedure to act so promptly, safely, and surely as the utilization of an existing biliary fistula, through which to freely bathe the upper intestinal mucosa, with a hot hypotonic, mildly alkaline salt solution containing a physiologic dose of adrenalin. Undoubtedly the best place for the absorption of fluids in the economy is the upper intestinal tract. The best excitant of normal peristalsis of the same would be some such above-described *hot* easily assimilable fluid. It is an accepted law of physics that fluids flow through capillaries for the walls of which they have an affinity. Hence, with such instillation there starts up once more, aided by this peristalsis, the flow through the portal capillaries, the splanchnic stagnation is overcome, and the picture changes most gratifyingly to one of peace and comfort. It might be insisted that the Murphy drip or Kanavel's continuous hypodermocleisis would accomplish the same results. Based on physiologic grounds as well as personal clinical experience, the assertion can be made that neither the one nor both combined accomplish quite the same results. In hypodermocleisis the change in the splanchnic circulation is only secondarily affected, there is no influence on the peristalsis of the small intestine. Colonic instillations by a reversal of a normal physiologic process, it is true, are absorbed, enter and improve the portal circulation, but neither so marked in degree nor so efficient in kind as when the same fluid bathes the jejunal lining.

Whether the claim of Paterson, that the cure of stomach ulcer after the making of a gastrojejunostomy is a chemical one due to the constant bathing of that ulcer with alkaline bile, is true or not, I cannot agree with him that the stomach is entirely indifferent to the presence of bile. Nor have I lost, with growing experience and improvement in my operative technic, my respect for the symptom-complex "vicious circle" as applied to ordinary gastro-enterostomies.

Whatever the cause permitting the flooding of the stomach with bile (even the brief anesthesia for some minor work), we know how regularly follows the spontaneous emptying of that stomach by emesis. I am quite prepared to admit that with every gastro-enterostomy some bile enters the stomach, and, further, that the gastro-enterostomized stomach develops in a relatively brief time a tolerance thereto. What I do claim, however, is that in those cases of stomach surgery complicated by the need of biliary fistulæ, whether gastro-enterostomies with or without excision of ulcer, resections of the stomach for malignant disease, or resection of ulcer-bearing area, I have been able to obviate those serious complications above described by the utilization of such biliary fistulæ.

Hence it was but a step, after such a clinical demonstration of its efficacy, to add to the technic of a gastro-enterostomy or stomach resection a *temporary biliary fistula* made in the normal gall-bladder. A double purse-string suture, inverting around a small rubber tube the fundus of the gall-bladder, and the bringing out of the same tube through the abdominal incision or through an appropriately placed stab puncture complicates the stomach surgery but little more than the making of a stab puncture through the abdominal flank for peritoneal drainage. For the past two years in a majority of my gastric operations this has been done. One hesitates to speak in numbers of stomach operations when in such close proximity to the Mayo Clinic. The writer has had in the past two years a scant twenty in which to study the data herein described. The results have,

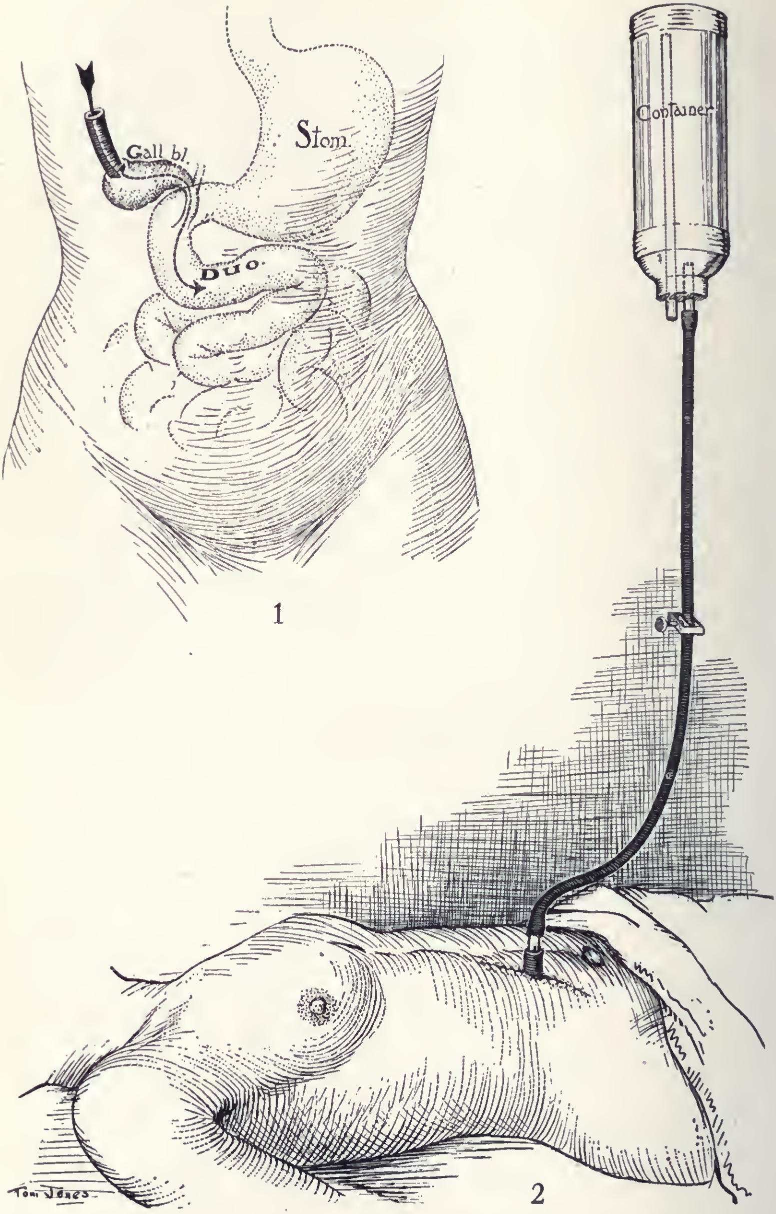


Fig. 37.—1. Tube in gall-bladder; arrow denotes path from gall-bladder via cystic and common ducts to duodenum. 2. Thermos-container for fluid and rubber tube connections with drainage-tube which is seen projecting from incision in abdominal wall.

however, been so gratifying when this procedure has been utilized that I have the temerity to here endorse and recommend its trial.

With such a fistula established, one has so good a control of the usual complications of the situation that a veritable sense of security of the convalescence of and assurance of comfort for the patient obtains. During the early postoperative hours the bile, being allowed to escape externally, fails to disturb the more or less paretic stomach. Under perfect control, in interrupted or continuous flow, the bile can be made to take its normal internal or its artificial external flow. Complete control of the vicious circle phenomena can thus be had. Failure of control is proof positive of faulty anastomosis and equally strong indication for prompt reopening. By this means I have, to my sorrow, realized an angulation of efferent loop to exist and to successfully correct it. Through this tube can be introduced, *distal to the stomach*, such fluids as otherwise would have to enter through the mouth, anus, or skin. If by the mouth, undesired and undesirable stomach peristalsis would be provoked. If by the colon, with some discomfort and occasional failure of absorption. If by hypodermocleisis, slight influence on peristalsis is effected. Is there need of renal flushing, abundant appropriate fluids can slowly and continuously be introduced to the best of all areas for absorption. Is there need of an alkali to correct an acidosis, here, par excellence, is the point for its absorption. Is there need of food, dextrose solution, 2 per cent., combined or not with any desired liquid peptones, is at command. Is there indication for a cathartic, here we can introduce the alkaline cathartic, sodium phosphate, with greatest benefit. Is there hemorrhage, something can be done to bathe the bleeding areas with those fluids reputed to aid in blood coagulation, *e. g.*, calcium lactate or chlorid, horse-serum, adrenalin.

At this point a word of caution suggests itself as to the nature of the solutions one may not use through this tract. The mucosa of the cystic duct and common duct are normally bathed by an *alkaline* secretion. Failure to bear this in mind by instilling mildly acid solutions—*e. g.*, washing out the gall-bladder with weak Thiersch solution—resulted in such edema of the cystic mucosa as to occlude the duct for even a week. Use, therefore, *neutral* or *alkaline* menstrua. Fluids of high specific gravity, crenate body cells, fluids of very low specific gravity cause them to swell; hence an effort to nearly approximate the density of the blood-serum or bile in making up the solutions will render their use more facile and efficient. Fluids of slightly lower specific gravity than normal are to be preferred because more easily absorbed. When the biliary fistulæ is in the common duct, with the tube inserted through it well into the duodenum, after Matas' suggestion, then anything that can be borne by the duodenum can be inserted through it—*e. g.*, milk, soup, cathartics, medicaments—as he has demonstrated. Before beginning the first instillation it is highly desirable to wash out the gall-bladder in order to be rid of any clots, thickened mucus, etc., that might interfere with the flow through the cystic duct. The fluids should be allowed to flow by gravity from an elevation of 12 to 20 inches. When working properly it causes absolutely no discomfort to the patient if controlled to the rate of flow of 5 to 10 drops per second. The amount that can be injected is practically only limited by the capacity of the intestines and blood-vessels of the patient, which with too excessive hydration begin to show various edemas—lungs, serous cavities, of hands and feet. This has begun to appear after the injection during a single night of between 3 and 4 liters. It did no damage, and speedily disappeared on interrupting the procedure.

In conclusion, I desire to invite your serious consideration of what I am sure you will at first thought regard as a complication rather than an improvement in the technic of gastric surgery; to ask you to try it in your more serious and major surgical interferences with stomach integrity in preference to the simpler gastro-enterostomy for chronic pyloric stenosis. Then I am convinced you will find it, if properly used, rather a conservative detail than a surgical insult.

NOTE.—An extensive report of this work was recently made before the Minnesota State Medical Society, and probably will be published in its journal.

CLINIC OF DR. DEAN D. LEWIS

PRESBYTERIAN HOSPITAL

NEUROLYSIS AND NERVE SUTURE

Summary: Presentation of 4 cases illustrating the mechanism of the production and the results of injuries to nerves and the technic of the operations for repair. Necessity of early exploratory operation. Autoplastic transplantation of fat the best means of preventing the development of vicious cicatrix. Importance of preventing the overstretching of paralyzed muscles in the after-treatment.

THIS patient, a colored male aged forty-three, was held up and shot January 14, 1916. The bullet entered the neck upon the right side at the level of the cricoid cartilage about the middle of the sternocleidomastoid muscle. The patient was unconscious for a few minutes and was immediately taken to a hospital, where the bullet was located by means of the *x*-ray, and was removed from the back, on the left side, near the posterosuperior angle of the scapula. Upon becoming conscious the patient stated that he remembered, immediately following the shot and before losing consciousness, the arm felt numb and hung limp like an empty coat sleeve.

The patient has not improved any as far as the use of the arm is concerned. He entered the Presbyterian Hospital October 3, 1916, for treatment.

The patient at the present time is unable to abduct the upper extremity, to flex or to supinate the forearm. Although unable to supinate the forearm, he has good use of the extensor group of muscles, which do not seem to have lost any power. An examination of the neck reveals a scar which indicates the point of entrance of the bullet, and a scar over the back in the position already noted which indicates the point of exit (Fig. 38).

The deltoid, supraspinatus, infraspinatus, biceps, brachialis anticus, supinator longus and brevis muscles are all paralyzed, and there is marked atrophy of these muscles. There is no marked disturbance of sensation at the present time, although

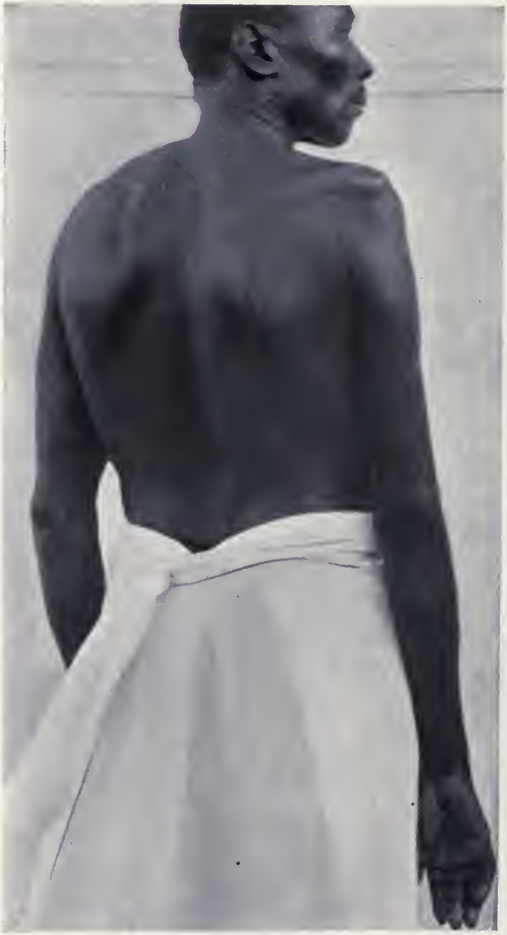


Fig. 38.—Gunshot wound of brachial plexus showing wound of exit over the left scapula, and atrophy of the muscles supplied by the nerves involved. The lateral trunk of the brachial plexus was injured. The muscles supplied by the fifth and sixth cervical nerves were the only ones affected.

there is some slight disturbance of sensation over the lower deltoid region and over the right thumb.

The muscles which are involved are supplied from the fifth and sixth cervical nerves, which unite to form the lateral trunk of the brachial plexus, and, judging from the fact that the loss of function came on immediately and was limited to the muscles supplied by branches from this trunk of the brachial plexus, we have no doubt that we are dealing with a lesion of this nerve trunk fairly high up, beneath the scalenus anticus. It is almost ten months since the injury. An exploratory operation should have been performed shortly after the injury, for the prospects of improvement are better when an early operation is performed. Exploration in many of these cases is indicated. This procedure should, I believe, be advocated, especially in civil life, for the exact nature of the lesion cannot be determined in any other way, and if the conditions indicate a certain procedure, such as nerve suture or neurolysis, the operation can be performed at a time when the prospects of recovery are the greatest.

Abundant opportunities have been offered during the recent wars to make an extensive and exhaustive study of nerve injuries. It has been found that in many cases in which paralysis has developed the nerve has not been completely severed. It has been contused or grooved, and the functional disturbance which results is often due to the contraction of cicatricial tissue within or about the nerve.

In this case we will expose the lateral trunk of the brachial plexus because, as I have already pointed out, the distribution of the muscle atrophy points to the injury of this trunk. An incision carried down the posterior border of the sternocleidomastoid muscle, and bending outward near the clavicle into the supraclavicular fossa, should give a good exposure (Fig. 39, 1). After the posterior border of the sternocleidomastoid is retracted toward the median line the outer border of the scalenus anticus is exposed, and emerging between it and the scalenus medius may be found the nerve trunk for which we are looking.

When this trunk is exposed there is found a good-sized neuroma which can be dissected off from the nerve trunk proper (Fig. 39, 2, 3). In this case it seems as if the bullet had grooved the outer part of this nerve, and the neuroma which has formed does not involve the entire thickness or circumference of the

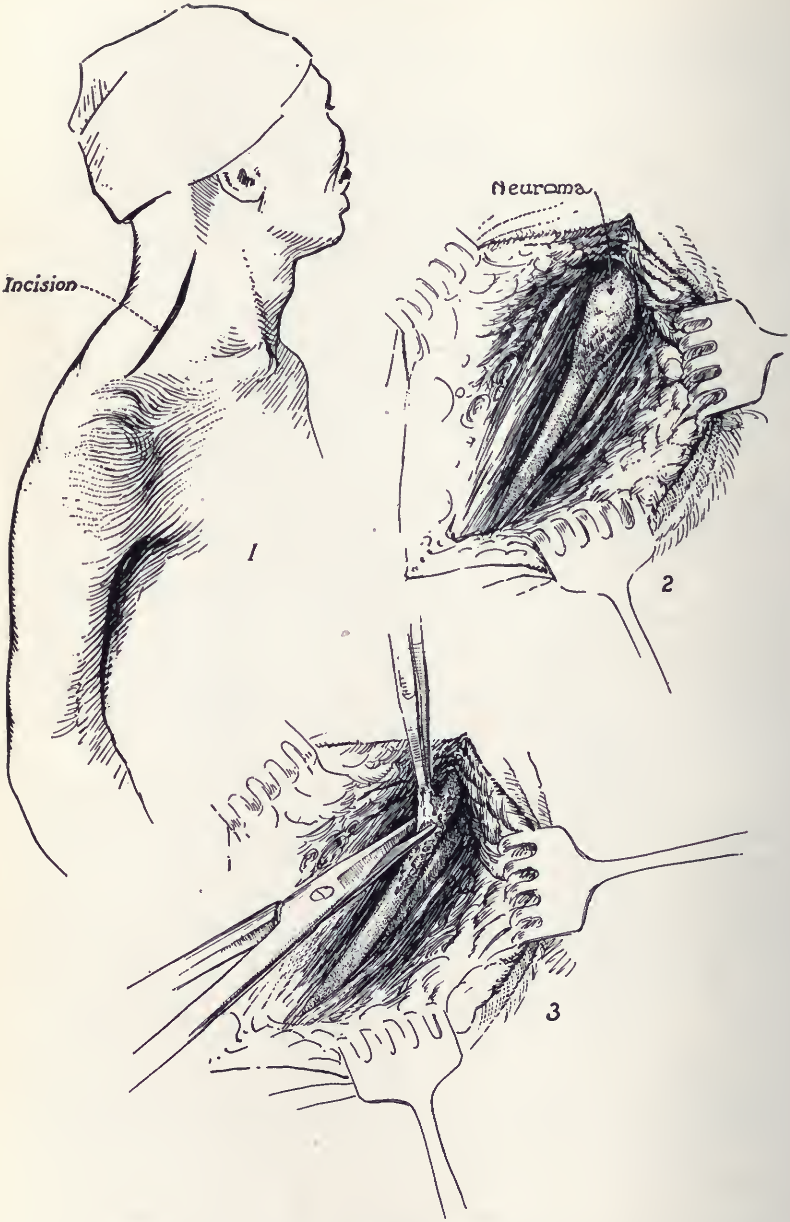


Fig. 39.

Figs. 39, 40.—Illustrating the incision and the different steps in the operation of neurolysis, fat being used for this purpose on the lateral trunk of the brachial

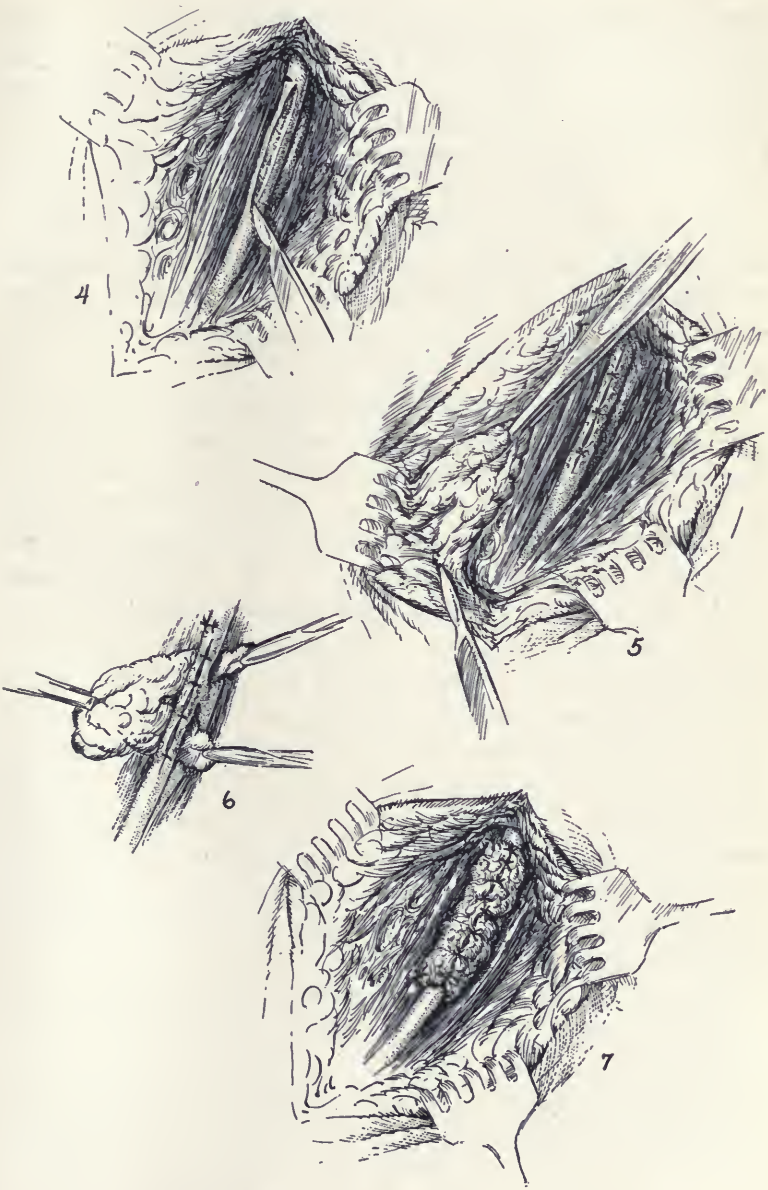


Fig. 40.

plexus. The incisions were made into the nerve (Fig. 40, 4) to determine whether or not healthy axis-cylinders were present. The source of the flap of fat is shown in Fig. 40, 5.

nerve. I shall nick the trunk above the neuroma to see how far the scar-tissue has extended. When the nerve is nicked just above the level of the neuroma healthy nerve-fibers are exposed. I shall also make a superficial incision into the part of the nerve in which scar-tissue has formed to see whether or not there are healthy nerve-fibers, for the choice of operation depends upon the condition of this segment of the nerve trunk (Fig. 40, 4). There seem to be healthy axis-cylinders in this intervening segment. Therefore I shall not attempt resection of this segment, but shall resort to neurolysis, the scar-tissue forming the neuroma having been dissected off the nerve trunk.

That neurolysis may be decidedly beneficial is indicated by the cases observed by Hashimoto during the Russo-Japanese War. But four nerve sutures and three nerve transplantations were attempted in the 50 cases operated on and observed by him. The results of the 3 cases of nerve transplantation were unsuccessful. In 43 cases neurolysis was attempted. The results were very good in 10 cases, good in 15, satisfactory in 3, questionable in 4, and unsatisfactory in 11. In 7 cases neurolysis was attempted three hundred days or more after the injury. In this series the results were good in 4 cases, questionable in 1, and unsatisfactory in 2. In 43 cases treated by neurolysis good results were obtained in 65 per cent., or, if the 4 questionable cases are included, in 74.4 per cent. The results obtained by neurolysis after two hundred days had passed from the time of injury were doubtful. This operation is being attempted almost three hundred days after the injury and, according to Hashimoto, the prospects for complete recovery are not favorable.

Many different materials have been used for neurolysis. That no one has been uniformly satisfactory is indicated by the number that have been employed. Material used for tubulization after neurolysis must be capable of good sterilization, must not act as a foreign body, and must not contract adhesions with the nerve. Decalcified bone tubules, iodoform gauze, hardened gelatin tubes, and hardened blood-vessels of calves have all been used. Hashimoto used calves' arteries hardened in formalin after the method of Foramitti. In 1 case reported by Hashimoto amputation became necessary four months after tubulization with a hardened artery was attempted. The hardened blood-vessel was almost entirely absorbed, only a few elastic fibers remaining in some places. Where at the first operation an avascular thickening was found, there was at the second operation a soft reddish segment abundantly supplied with blood-vessels.

I believe that at the present time there are but two materials which should be considered in this connection. These are fat and fascia. I have successfully used fascia to surround the line of suture in the radial nerve after resection and suture. This has been over two years, and there has been no interference with function from contraction of the fascia placed about the line of suture.

Recently there has been considerable discussion against the use of fascia for neurolysis. Kredel has been particularly emphatic against its use because of an experience he had in which the fascia was applied directly about a scar in a nerve. Contraction occurred in the fascia, necessitating a second operation. That good results may follow its use is indicated by the few cases which have been reported. Law has recently reported 2 cases of brachial plexus injury in which the line of suture was covered by free fascial flaps. There has been a continued improvement in these cases, with no evidence of cicatricial contraction of the fascia. Rowan, in a recent personal communication, relates the history of ulnar nerve suture combined with fascial tubulization in which there has been complete return of function. Against these successes may be mentioned the cases of Kredel and Goldmann. Goldmann placed fascial strips about the median and ulnar nerves. After six months the nerves had to be exposed because of impairment of function. The fascia was then found to be adherent to the nerves. Contraction of fascia will occur when this material is placed about recent scars. This limits decidedly the usefulness of fascia for neurolysis and tenolysis, for in the majority of cases scar-tissue in considerable amounts is encountered in conditions in which these operations are indicated.

Experimentally it has been shown that transplanted fat heals in position with little or no reaction of the foreign body type. There is but little leukocytic infiltration. In the early stages transplanted fat becomes adherent to nerves about which it is placed. During regeneration of the fat the adhesions become less and less, and the fat either merely surrounds the nerve or is separated from it by a connective-tissue zone of microscopic width. Eden and Rehn believe, as a result of their experimental work, that no other autoplastic transplantable material contracts so few adhesions with tissues about which it is placed as fat.

I shall use fat to cover this nerve trunk, for it is the best tissue for this purpose. There is a branch which apparently passes into the muscle, and I shall split the fat transplant to surround it. Both ends of the transplant will be fixed in position, so that it cannot slip down on the nerve trunk (Figs. 40, 41).

In the after-treatment a pull upon the paralyzed muscles should be prevented. A dressing will, therefore, be applied which will relax the paralyzed muscles, for relaxation of these during the process of repair is essential. This was pointed out some time ago by Thomas, but has been much neglected by the medical profession, especially in the treatment of anterior poliomyelitis.

Improvement in this case will be slow. It is difficult to estimate the length of time before there will be distinct evidences of improvement.

CASE II

This boy, aged eight, was admitted to the Presbyterian Hospital October 24, 1916. The following history was obtained: The boy fell upon a piece of glass July 15, 1916. He was taken to a hospital where the wound was sutured. He remained in the hospital three and one-half weeks. Nothing definite can be elicited concerning the injury. There is atrophy of the thenar group of muscles, and the muscles supplied by the ulnar nerve are also atrophied. A claw-hand is beginning to develop. The scar passes transversely over the course of the median nerve, just above the wrist and into the palm, over the course of the deep branch of the ulnar nerve.

Pressure just above the scar over the median nerve causes pain, and a neuroma can apparently be felt at this point.

An operation is indicated to determine the nature of the injury in this case and the character of the repair. An incision corresponding to the course of the scar is made and the median nerve is readily found. Evidently an attempt had been made to unite the divided ends of the median, but a large neuroma has formed. This neuroma is resected, the resection being carried back into healthy nerve-tissue. In attempting to find the point of division of the ulnar nerve the dissection has to be carried into the palm, where the deep branch is found. The point of division is surrounded by a dense scar, and though an attempt is made to find a healthy portion of nerve to do an anastomosis, this is not entirely successful. The divided ulnar ends are sutured, but there is more scar-tissue in the distal segment than one would like. The suture lines in both the median and ulnar nerve are surrounded with free fat transplants. The divided flexor tendons had been united. Although these are somewhat matted together, no attempt is made to perform a tenolysis. The hand is dressed in flexion in order to permit of union of the nerve ends without undue tension.

Note.—This patient was seen December 6, 1916, and the cast removed. There seems to be some improvement in the lumbricales and in the interossei. This improvement is not marked enough, however, to permit of any very positive statements.

CASE III

Here is a patient, a boy aged five and one-half years, who was admitted to the Presbyterian Hospital the 10th of October, 1916. A year ago last May the child sustained a compound fracture of the right femur, just above the condyles. The lower end of the upper fragment projected backward at the time of the injury. The fragments were placed in apposition soon after the injury, but during a change of dressing they apparently slipped somewhat, although there is even now no marked displacement or deformity. The extremity was immobilized twelve weeks, and when the cast was removed a drop-foot and atrophy of the anterior tibial group of muscles were noted.

There is nothing in the past or family history which has any bearing upon the present trouble.

An examination of the right knee reveals some limitation of motion. Flexion is good, but extension lacks about 10 degrees of being complete. There is a scar over the back and outer aspect of the knee-joint a little external to the course of the external popliteal nerve. This scar is evidently the result of a posterior displacement of the lower end of the upper fragment which pierced the skin at this point. There is marked drop-foot upon this side and considerable atrophy of the anterior tibial group of muscles. There is some response to galvanic stimulation over the nerve, but no response to faradic stimulation. Undoubtedly we are dealing with an injury of the external popliteal. It is difficult to state whether the injury has caused complete division or whether the nerve has been stretched over the bony fragment which projected posteriorly.

Loss or alteration of function in these cases may be due to secondary involvement in callus or to stretching over bony points in cases in which nerve is associated with bone injury. A scar fixing a nerve over a bony point may cause marked functional disturbance. In some of these cases paralysis develops late. Borchardt reports a case in which the paralysis developed two years after the removal of dead bone from the shaft of the humerus, the contracting scar causing the loss of function. In many of these cases freeing of the nerve from the scar-tissue is enough to secure return of function, providing renewed compression from scar-tissue can be prevented. We will expose this nerve to determine the nature of the injury. An incision is made parallel to the course of the external popliteal nerve. The dissection must be made through scar-tissue. Below, the uninjured portion of the external popliteal nerve is easily found running through the fibers of the peroneus longus. When this is traced upward we come upon a thinned cicatricial strand connecting an upper normal with a lower normal segment. This middle segment is evidently composed mostly of scar-tissue. When incised but few normal axis-cylinders are found. If return of function is to be expected in this case the cicatricial intermediate segment must be removed and healthy nerve ends must be united. The intermediate segment will be removed, the resection being carried far enough up into the proximal segment until a granular cut surface indicative of normal axis-cylinders is found (Fig. 41).

The leg must be flexed in order that the ends may be united without tension. I dislike to flex the parts in doing nerve suture, but believe that the chances of repair are much better after end-to-end suture than after lateral implantation into a neighboring nerve or after tubulization. Anatomic repair, as shown by Lewis and Kirk, is much more complete after end-to-end suture or tubulization than after lateral implantation. The flap methods of repair are not to be relied upon, as the results, as far as anatomic repair is concerned, are the worst of any method of nerve repair.

When the leg is partially flexed the nerve ends can be united without tension (Fig. 41, 2). But three sutures of fine silk are required to approximate the nerve ends. Owing to the large amount of scar-tissue the line of suture is surrounded by fat (Fig. 41, 3). The skin is closed with a continuous silk suture.

The leg will be immobilized in partial flexion for about twelve weeks, at which time repair at the line of suture should be well advanced. The leg will be gradually extended after that time. The foot will be dressed in dorsal flexion in order to relieve any pull upon the paralyzed muscles during the process of repair. The foot will be maintained in this position for many weeks, depending somewhat on the progress of the case.

CASE IV

Our next patient, a woman aged sixty-five, was admitted to the Presbyterian Hospital November 15, 1916. This patient gives a history of falling upon a broken china jar and cutting the flexor surface of the right forearm about 2 inches above the wrist. The wound was sutured shortly after the injury. Loss of sensation over the thumb and two and one-half fingers on the palmar surface were noted soon after the injury. Anesthesia was also noted over the area of distribution of the median nerve posteriorly.

The fingers and wrist were painful for seven weeks, at which time an operation was performed and the divided tendons sutured. No attempt was made to suture the median nerve.

When an examination was made at the hospital the two distal

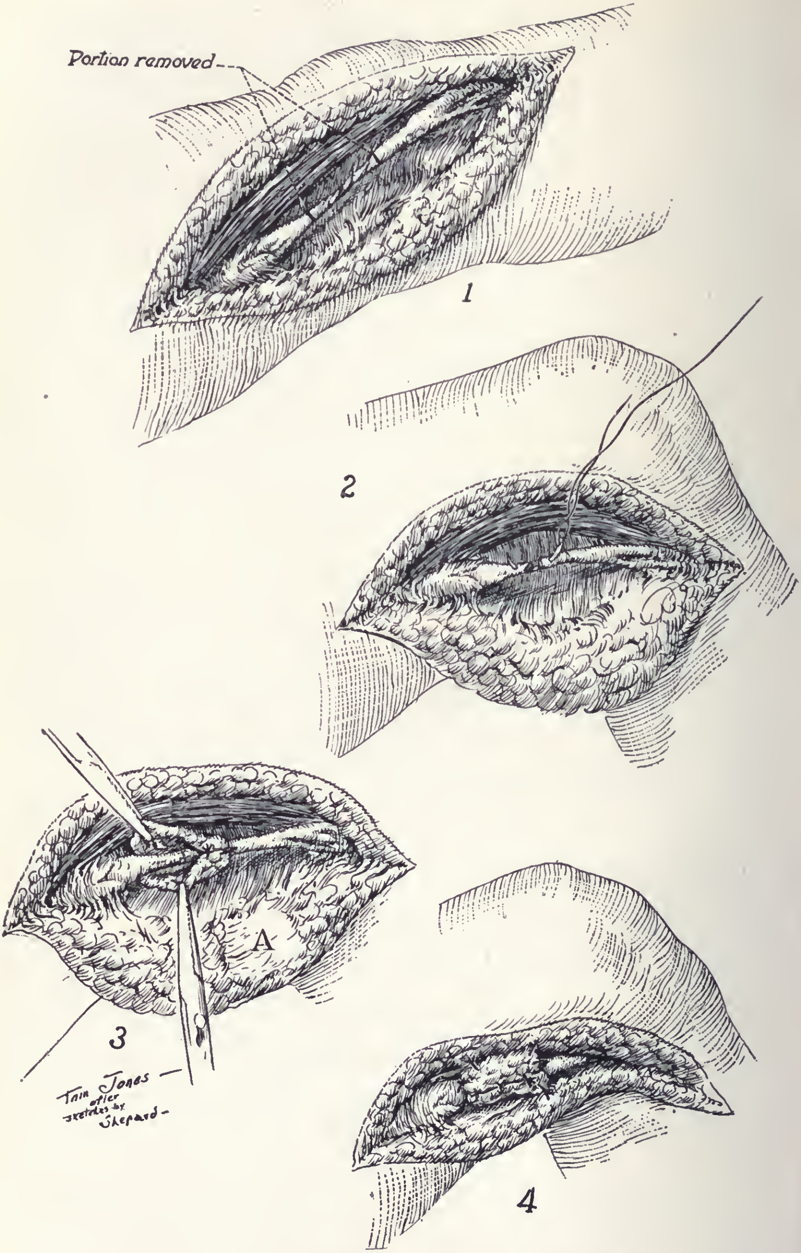


Fig. 41.—Illustrating the different steps in the operation of nerve suture followed by neurolysis with a free fat transplant. In 3 at *A* is seen the area from which the fat-flap was taken.

phalanges of all the fingers were flexed. These could be extended with difficulty because they were fixed at the wound above the wrist. Attempts to extend the fingers caused considerable pain. There has been some return of sensation to the parts previously anesthetic. The skin of the hand and fingers has the peculiar white, shiny appearance associated with nerve injuries.

The patient's chief complaint is of a severe pain which is so bad that the patient's general health has suffered. At times this is a burning pain, at other times sharp and lancinating, and at other times aching in character. It is so severe that the patient is willing to subject herself to almost any operation that will afford relief. No neuroma can be palpated over the course of the median nerve. The injury is probably so recent that a neuroma could not have formed.

The upper end of the median nerve is probably caught in a scar, which accounts for the severe, almost continuous, pain.

A constrictor will be applied because an artificial ischemia facilitates dissection. A flap is turned back, exposing the structures upon the anterior surface of the forearm low down. This flap includes the original scar. The sutured tendons have a rather edematous, swollen appearance, but evidently there is no infection.

The distal segment of the median nerve is readily found. The incision is prolonged upward in order that the proximal segment may be found before it enters the field of the original injury. When this segment is traced downward its end is found embedded in scar-tissue, but no neuroma has formed. The end is dissected out of the scar, the scar-tissue is resected until healthy axis-cylinders are found, and an end-to-end union is made, the wrist being somewhat flexed to permit of this. A fat transplant is placed about the line of suture and a large free fat transplant is placed between the different layers of flexor muscles.

The skin is closed with a continuous silk suture and an immobilizing dressing is applied before the constrictor is removed.

Note.—The patient left the hospital on the ninth day, healing having occurred by primary intention. She has been relieved of the constant nagging pain from which she sought relief.

BLEEDING NIPPLE, WITH PLASTIC OPERATION UPON THE BREAST

Summary: A patient complaining of the discharge of bright red blood from the right breast; clinical significance of a bloody discharge from the non-lactating breast; differential diagnosis of chronic cystic mastitis; plastic operation for the cure of chronic cystic mastitis. This operation best adapted for patients in whom the fat tissue of the breast predominates over the glandular elements.

November 4, 1916.

This patient, Mrs. S. H., aged forty-two, was married when nineteen years of age. She is the mother of five children. She was operated upon five years ago for gall-stones. There is nothing in the past or family history which has any bearing upon the present trouble.

Six months before entering the hospital the patient noticed a blood-stain upon her night gown where it touched the breast. She wondered where the blood came from, and upon squeezing the right breast bright red blood was discharged. She had noticed no pain in the breast and had received no injury of the same. When the first baby was born an abscess formed in the right breast which required lancing.

During the past six months blood has been discharged from the nipple almost constantly, although the amount has varied considerably. The gauze worn over the nipple was always blood-stained. Sometimes the blood was bright red; at other times dark and granular, the blood having decomposed.

The clinical significance of a bloody discharge from the nipple of a non-lactating breast has been variously interpreted. A scanty, thin, sanguinolent discharge has usually been regarded as suggestive of a malignant growth; a mucoid discharge, of a benign growth, and a markedly bloody discharge, of an intracanalicular papilloma. Bloodgood believes that a discharge from the nipple, except during lactation, may be looked upon as a sign of a benign lesion and not as a symptom of cancer. If the discharge is serous or bloody, it is a positive sign of an intracanalicular papilloma. In senile parenchymatous hypertrophy there can often be expressed from the nipple a thick brownish material, which the patient rarely observes, which is formed by the accumulation of the products of degenerated epithelium.

The pathologic changes associated with the escape of a serous, serohemorrhagic or hemorrhagic discharge from the nipple have many interesting features, and must be kept constantly in mind when attempting to make a diagnosis. The lesions most frequently associated with a serohemorrhagic or hemorrhagic discharge from the nipple are regarded by some (Kaufmann) as rare, but most surgeons can recall some few cases of bleeding nipples, most of which have not been carefully analyzed. The pathologic changes associated with a hemorrhagic discharge have been so variously interpreted and have received such a variety of names—such as encysted medullary carcinoma, cystofibroma, villous carcinoma, and duct cancer—that it is often impossible to determine whether the lesion which is described is benign or malignant. It is quite evident that the term "duct cancer," which was applied in former years, especially in England, to the papillomas in the ducts, which are found superficially just beneath the areola, and which are so frequently associated with a bloody discharge from nipple, is a misnomer, for the majority of these are benign, and although some may be possessed of malignant potentialities they remain for years without changing their benign characteristics.

In making a diagnosis of the change in the breast under consideration the common intracanalicular papilloma can be ruled out. These are usually situated superficially beneath the areola, the duct being dilated to form what might be called a cyst in which blood and the papilloma are found.

I can best illustrate this type of lesion by quoting from the history of a patient upon whom I operated two years ago. This patient, forty-six years of age, had noticed for eight years an intermittent serohemorrhagic discharge from the left nipple. The discharge had recurred at periods of from four to six months during these eight years, would last some time, and then disappear.

For nine weeks before entering the hospital the discharge had been almost continuous. Two weeks before the patient had noticed a small swelling about the size of a hazelnut situated superficially just beneath the areola to the inner side of the nipple. This swelling developed rather quickly. When pressure was made over this swelling a stream of serohemorrhagic fluid, at times almost pure blood, was discharged from the nipple, the size of the swelling being greatly reduced. This case is cited as it indicates the common position of the intraductal papilloma, the lesion most frequently associated with a discharge of blood from the nipple.

This patient's breasts are large and pendulous, and when both are palpated they have a peculiar irregular shotty feel. No serohemorrhagic or hemorrhagic material can be discharged from the nipple when pressure is made upon the left breast, When pressure is made upon the right breast, the pressure being applied upon the different quadrants separately, a dark brown hemorrhagic material is expressed from the nipple.

The involvement of both breasts, and the fact that a bloody fluid can be expressed from all parts of the breast, makes the diagnosis of chronic cystic mastitis almost certain. There are no clinical evidences of malignancy. A small papilloma situated deep in the ducts, of which I have recently seen two examples, will give rise to a bloody discharge from the nipple, but blood can be expressed only when pressure is made upon the parts of the breast immediately adjacent to the tumor, and in the two instances which I mentioned the breast involved did not have the peculiar shotty feel so characteristic of the adenocystic type of chronic mastitis.

There are no evidences of malignancy in this case, and I desire to remove the glandular portion of the breast and to leave the fat from which the breast can be reconstructed. The operation which I shall perform in this case can be used to advantage when the breast is well developed and in middle-aged patients in whom the fat predominates. I have performed this operation in a girl nineteen years of age with cystic mastitis, but the glandular tissue greatly preponderated over the fatty, and the breast

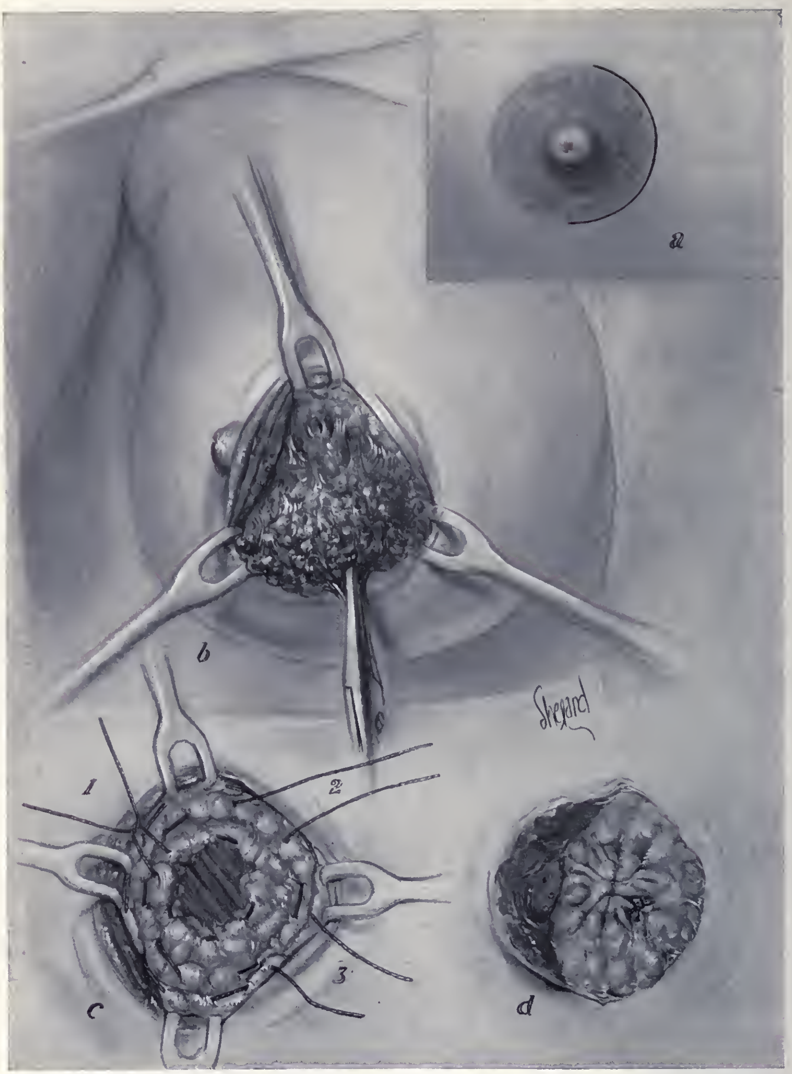


Fig. 42.—*a*, Line of incision; *b*, areola dissected up, milk-ducts cut, and gland being separated from the surrounding fat tissue; *c*, purse-string sutures inserted preparatory to obliterating the dead space and reconstructing the breast; *d*, purse-string sutures tied; areola about to be stitched back in place.

from which the glandular substance was removed is flattened and much smaller than the other. I believe that this operation is better than complete removal even when the breasts differ so much in size after the operation. If both breasts are involved the operation gives very satisfactory results.

The incision is made at the junction of the areola with the skin to the inner side of the nipple, as illustrated in Fig. 42 at *a*.

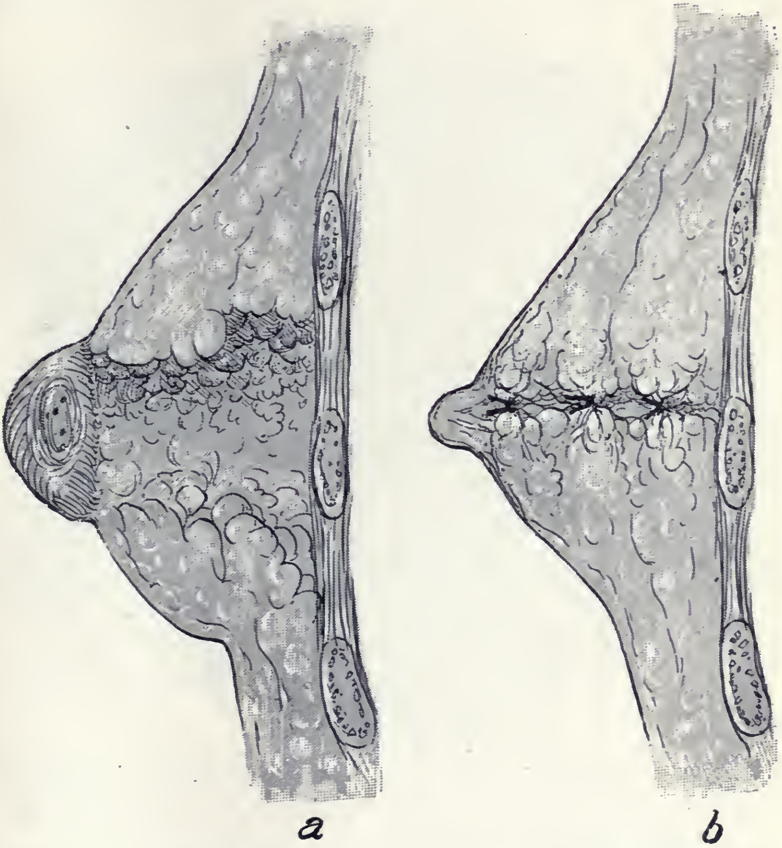


Fig. 43.—*a*, *b*, Diagrams illustrating the manner in which the surrounding fat tissue is made to fill in the space left by the removal of the glandular tissue.

The areola is then dissected up and the milk-ducts cut as they enter the nipple. The glandular tissue of the breast is then grasped with artery forceps and is gradually pulled out, the dissection being carried on between the glandular tissue and the fat

(Fig. 42, *b*). The entire glandular substance of the breast can be removed in this way. After the glandular substance has been removed, purse-string sutures of catgut are placed through the fat from below upward. Usually three purse-string sutures are enough to reconstruct the breast (Fig. 42, *c* and *d*. Compare also Fig. 43, *a* and *b*). The skin-flap containing the areola is then sutured back in position. I have not used a drain in these cases. There has been considerable discharge of serum, which has been rather annoying, and I believe that it would be best to use a small gutta-percha or cigarette drain.

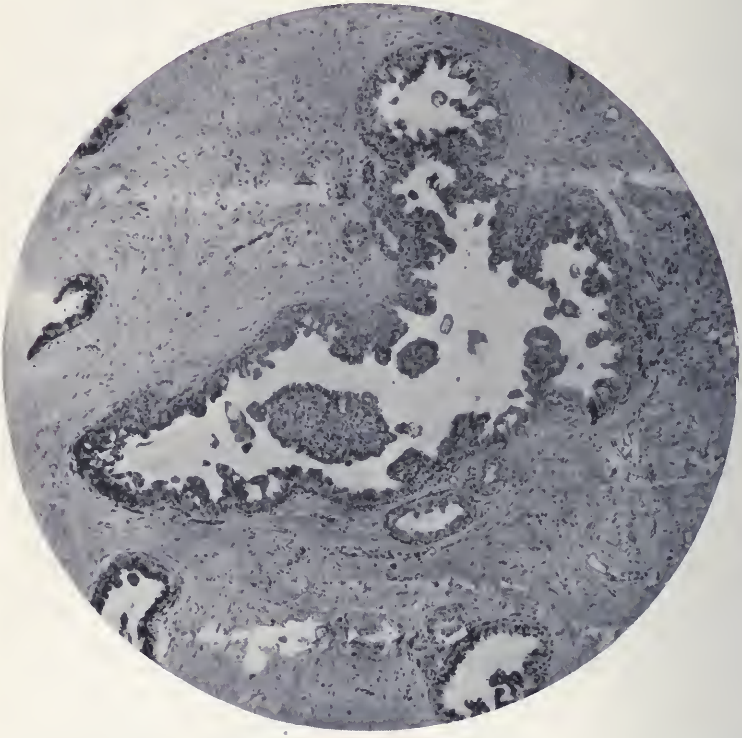


Fig. 44.—Section of adenocystic type of chronic cystic mastitis. A serohemorrhagic discharge from the nipple was the first symptom which attracted attention to disease of the breast.

The glandular substance which I have just removed is fairly riddled with small cysts, some of which contain a bloody, others a serohemorrhagic, and still others a mucoid, material. There are no gross evidences of malignancy, nothing even suspicious of malignancy, and I believe that we are dealing with the adenocystic type of chronic mastitis associated with a discharge of blood from the nipple. I shall remove pieces from a number of different parts of this breast in order that a careful microscopic study of the tissue can be made (Fig. 44).

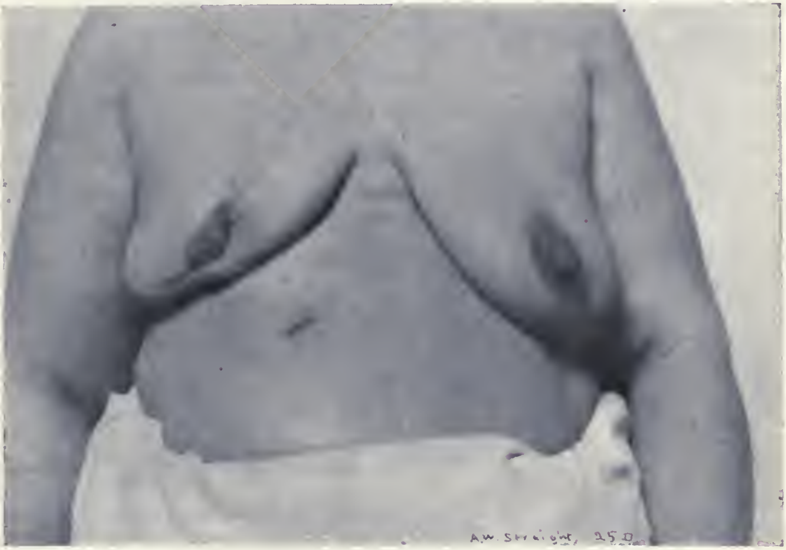


Fig. 45.—The glandular tissue of the right breast was removed by the plastic operation which has been described. The depression to the inner side of the nipple indicates the position of the incision through which the operation was done.

Bloodgood, in a personal communication, makes the following statement concerning the discharge of blood from the nipple. His cases are divided into the following groups:

Group A.—Cases in which women have had a discharge of blood from the nipple without the finding of any tumor. This group can be divided into two classes: Class I. Two cases have been operated upon. The breast was removed in these 2 cases and a simple papillomatous cyst containing blood was found. One case was operated upon fifteen years ago, and the other five years ago. Both patients are well and without recurrences.

Class II. No operation performed. He has had about 5 or 6 of these cases. In all but 1 the blood has disappeared, no tumor has developed, and the patients have remained well. In 1 case a tumor developed three years later and was removed. It was a cyst with a papilloma, and there had been no recurrence after a period of about two years.

Group B.—Discharge of blood from the nipple associated with a papillomatous tumor. All of these cases have been operated upon, and in all a papillomatous cyst has been found. The majority have been benign. He thinks that in only 1 or 2 cases which were malignant was there a discharge from the nipple. From his experience he finds that discharge from the nipple alone is not an indication for operation.

Bleeding nipples are most frequently associated with intracanalicular papillomas and the adenocystic type of chronic mastitis. The papillary growths occurring in the acini and ducts are essentially the same, and the papillary cystadenomata should be regarded as a part of abnormal involution, although not necessarily a late stage.

CONGENITAL PYLORIC STENOSIS

Summary: A patient presenting characteristic symptoms of congenital pyloric stenosis; differential diagnosis—pylorospasm; shortened peritoneal fold kinking duodenum, and tumor projecting into pyloric canal may simulate congenital pyloric stenosis—both rare; when to operate; results of operation; superiority of the Rammstedt pyloroplasty; technic of the operation; after-treatment as compared with that following gastro-enterostomy.

October 28, 1916.

This girl baby is eight weeks and four days old. She was born August 29th, at which time she weighed 6 pounds. Ever since birth there has been considerable regurgitation of food. When four weeks old she weighed 6 pounds and 4 ounces, having gained 4 ounces in four weeks. At this time projectile vomiting was noted and distinct peristaltic waves, although no tumor could be palpated. During this time the baby has been under the care of Drs. Skiles and Helmholz, and in spite of changes in the character of the feeding there has been a progressive loss in weight, so that now, five weeks and two days since the beginning of projectile vomiting and the appearance of peristaltic waves, the baby weighs but 5 pounds and 4 ounces.

This baby presents symptoms which are characteristic of congenital pyloric stenosis, the diagnosis of which is usually regarded as easy. In the majority of cases the diagnosis can be easily made, but it is rather difficult to state just why this is so. It is probably due to the fact that at the age when the symptoms of congenital pyloric stenosis make their appearance there are few conditions presenting themselves which simulate it. Certainly age is a factor in the diagnosis and one on which considerable stress must be laid. The symptoms usually begin about the third week after birth, continuing until the child dies or improves under appropriate treatment. It is not unusual to see the symptoms of congenital pyloric stenosis begin still earlier, but it is rather unusual to find an untreated case in a child more than three months of age. This condition, therefore, occurs very definitely in a period between the third and twelfth weeks. It occurs much more frequently in males—14 of the 16 cases which I have observed have been in males.

The symptom which first attracts attention is vomiting. The vomiting frequently begins in the early stages as regurgitation, which becomes gradually worse, until within a few days or weeks it becomes distinctly projectile in character. The quantity vomited at any given time depends to a large extent upon the period of time which has elapsed since the last vomiting. At times these infants will go eight to twelve, even twenty-four hours, without vomiting, at the end of which time there is projectile vomiting and a large amount of fluid is ejected with much force. It is not unusual to see a child vomit a distance of 2 to 2½ feet. The time at which the vomiting occurs may be from a few minutes to several hours after the ingestion of food. Nothing about the character of the vomitus is distinctive. The character depends somewhat upon the length of time that the food has remained in the stomach. This statement should be modified to an extent, for at times a large quantity of watery fluid may be ejected after the stomach has apparently been emptied by previous vomiting. Of all the symptoms, vomiting is the most alarming.

Accompanying the vomiting and a direct result of the same is a decrease in the amount of feces. This has been called a constipation, but in the true sense of the word it is not, but is due to the reduction in the amount of material reaching the bowel. There is also a decreased absorption of water and a concentrated urine is passed in small amounts.

The general condition of these infants is often strikingly good when one takes into consideration the degree of the starvation resulting from the vomiting. They practically never have the brownish or grayish hue which is so frequently observed in cases of marasmus of the same degree of emaciation. The skin is nearly always clear, usually pale, and the subcutaneous tissues show a depletion in proportion to the severity of the vomiting. They are not the disturbed and irritated infants such as are seen in gastro-intestinal disturbances They are extremely hungry, but only a small proportion of the cases suffer from an accumulation of gas. The sleep is not disturbed and is usually sound, in this way differing markedly from the sleep of children suffering from nutritional disturbances.

The weight curve is of interest. It is not uncommon to have a history of a weight curve which, following the initial loss after birth, has a steady though not marked upward trend. This satisfactory weight condition continues but a short time after vomiting begins. The curve then tends to become stationary. If the case is being watched carefully there is apt to come a time when the loss in weight is much more rapid than it had been previously. This rapid loss is a danger signal, and when this occurs operative procedure must be considered.

The baby before us has, as stated before, all the symptoms of congenital pyloric stenosis. The projectile vomiting began at the time at which it is usually noted; the peristaltic waves are distinct; there is distention of the epigastrium, but I have been unable to palpate the tumor, and often I have been unable to do this even when the operation revealed a good-sized mass at the pylorus.

Concerning the differential diagnosis, Grulee states that the chief difficulty is in differentiating between stenosis and pylorospasm. A severe case of pylorospasm may simulate very closely congenital pyloric stenosis. In most cases of pylorospasm there are a few points which are very significant. It is not unusual to find pylorospasm beginning during the first few days of life. This is rather unusual in congenital pyloric stenosis. While congenital pyloric stenosis appears before the third month, pylorospasm is often observed in much older infants. It is not infrequently seen in children seven, eight, and nine months old. In most cases of pylorospasm there is a definite history of previous gastro-intestinal disturbance, usually dyspeptic in nature. In infants a few weeks old with pylorospasm the vomiting, epigastric peristalsis, etc., are much less marked than in a case of congenital pyloric stenosis of the same age. The symptoms of pylorospasm tend to increase in severity as the child becomes older, but the increase is not nearly so rapid as in congenital stenosis. The x-ray findings offer nothing which will differentiate between the two conditions.

Two other conditions must be considered in the differential diagnosis. These are so rare that they need only be mentioned. A shortened peritoneal fold may kink the bowel just beyond the pylorus. Such a case has been described by Grulee and Kelly. In these cases there is usually some cessation in the severity of the vomiting and biliary vomiting is rather common. Grulee has seen 2 such cases since he reported his first one. Downes has reported an interesting case in which a small tumor projected into the pyloric canal and caused symptoms which simulated closely those of congenital stenosis.

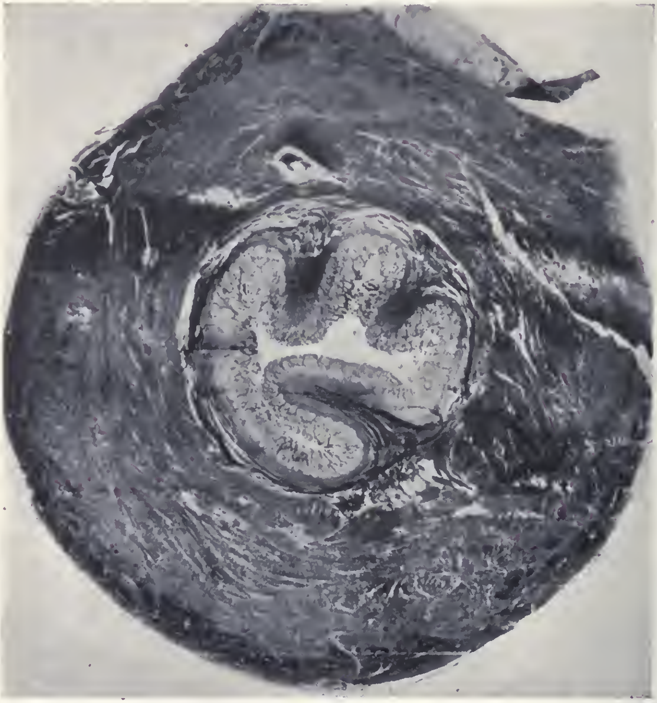


Fig. 46.—Illustrating condition of pylorus nine months after a successful gastro-enterostomy for congenital pyloric stenosis (Lewis and Grulee).

If the baby is losing ground after appropriate medical treatment has been tried, an operation for relief of the stenosis should be performed. Lewis and Grulee have had the opportunity of studying the condition of the pylorus two hundred and fifty-six days after a successful gastro-enterostomy. This gastro-enterostomy functionated perfectly, but two hundred and fifty-six days afterward the hypertrophy of the structures about the pyloric ring was as marked as at the time the operation was performed (Fig. 46).

A few years ago the results of operation for congenital pyloric stenosis were so uncertain that physicians hardly felt justified in recommending surgical treatment. The high mortality even at this time was not entirely due to the operative technic employed, for many of the cases were not recognized until they had become poor surgical risks, and even when recognized early medical treatment was continued so long that the infant was turned over to the surgeon for operation as a last resort.

In 1906 Thompson found recorded in the literature 156 cases of congenital stenosis. To these he added 1 of his own, making 157. The total number of operations performed up to that time was 89. These may be summarized as follows:

	Number.	Recovered.	Died.	Mortality.
Pylorectomy	1	0	1	100 per cent.
Divulsion	17	8	9	53 "
Pyloroplasty	12	6	6	50 "
Gastro-enterostomy	59	59	30	51 "

Since this paper was published the mortality has been greatly reduced. Only two of a number of operative procedures have proved to be sufficiently satisfactory to warrant adoption. These are posterior no-loop gastro-enterostomy and pyloroplasty. The largest series of cases which have been operated upon are those of Downes, Richter, and Scudder. Posterior gastro-enterostomy was originally employed by each of these surgeons, and the mortality was 32, 14, and 24 per cent. respectively. The total number of cases in the early series was 61, with a mortality of 22 per cent.

I have operated upon 16 cases, 3 of which died, the mortality being 18.7 per cent. In 12 of the cases a posterior no-loop gastro-enterostomy was performed. The first 5 babies recovered. The sixth baby died of peritonitis following opening of the abdominal wound on the fifth day. The convalescence up to this time had been especially good, and at the autopsy the gastro-enterostomy proved to be well advanced in the process of repair. The seventh baby died at the end of a week from perforation of the gastro-intestinal anastomosis. The eighth baby died after forty-eight hours, and the cause of death could not be determined when the autopsy was performed.

In the last 4 cases a Rammstedt pyloroplasty has been performed, and I believe that it is much superior to the posterior gastro-enterostomy. But little time is required to perform the operation; there is less manipulation; and the babies recover much more rapidly than after gastro-enterostomy. If care is exercised there is not much danger of cutting the mucosa. The greatest danger of perforating the mucosa is on the duodenal side of the pylorus, where the enlargement often ends somewhat abruptly. In the fourteenth case, in which a Rammstedt was employed, I perforated the mucous membrane, but this happened on the duodenal side, and the opening could be closed. The baby made a good recovery.

The operation is very simple. After opening the abdomen the pylorus is found, and the enlargement is grasped between the thumb and index-finger and delivered. An incision is made into it parallel to the axis of the bowel, down to the mucosa which bulges into the incision (Fig. 47). The opening is then enlarged by spreading the margins, which separate easily from the underlying tissue, with artery forceps (Fig. 47, *A*). No attempt is made to cover the mucosa. The hemorrhage from the cut surfaces, which is not great, can be easily controlled by a hot-pack or by transfixion.

Special attention should be paid to suturing of the abdominal wall. An incision through the right rectus heals better than one through the linea alba. After careful layer suture and the application of a dressing we wrap the entire abdomen from the margin of the ribs to the pubes with adhesive. A number of surgeons have spoken of the opening of the abdomen in these cases, and special care must be exercised against this accident.

The Rammstedt pyloroplasty has been employed by Downes in 35 cases. Eight deaths occurred in this series, giving a mortality of 23 per cent.

Shock has not been noted after either gastro-enterostomy or pyloroplasty. This has been mentioned by a considerable number of operators as being quite common after gastro-enterostomy. This lack of shock we believe to be due to the skill with which the anesthesia has been administered by Dr. Isabella Herb, ether being used. The anesthesia has been light, but still deep enough to permit of doing the anastomosis without difficulty and without forcing the intestines out of the abdomen.

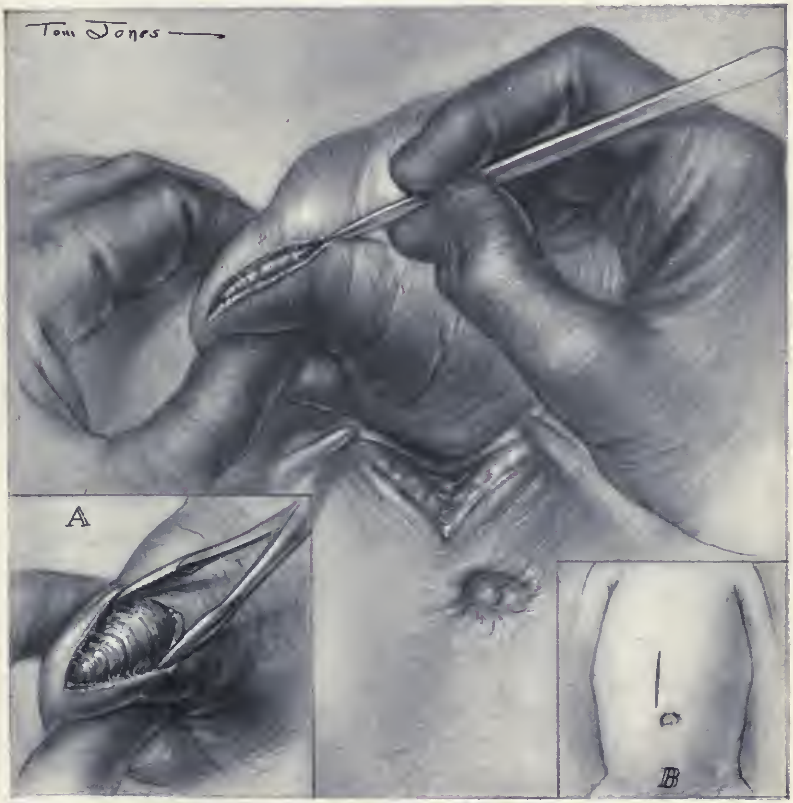


Fig. 47.—Illustrating steps in the Rammstedt pyloroplasty. The method of holding the pylorus between the thumb and finger and the site of the incision. Insert *A*, the lips of the incision are being spread with artery forceps. Insert *B*, rectus incision to right of median line.

Dr. C. G. Grulee has taken care of the postoperative treatment. The babies upon whom a gastro-enterostomy is performed have a hard time during the first thirty-six to forty-eight hours. The babies upon whom a pyloroplasty is performed recover very rapidly. In the after-treatment of the gastro-enterostomy cases Dr. Grulee has attempted to give the babies water by mouth within six hours after the operation. This is followed within two hours by a small amount, perhaps ½ ounce, of breast milk. Vomiting of a small amount of greenish liquid has almost always followed these attempts. This greenish fluid rarely contained the milk which had been ingested or curds of the same.

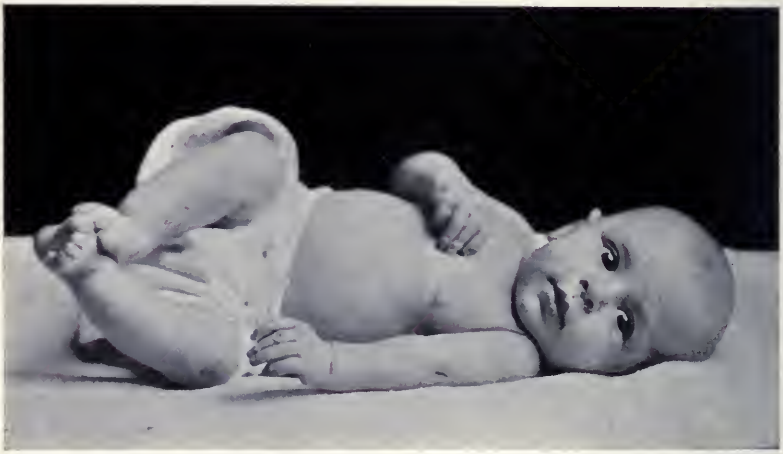


Fig. 48.—Baby upon whom a Rammstedt operation has been performed. The baby has gained 4½ pounds in eight weeks.

These cases have never been fed oftener than every four hours, the quantity of food being gradually increased from ½ to ¾ ounce. Depending upon the severity of the case and the persistency of the vomiting, it has required from one to two weeks to get the child on the required amount of food. Often the child is so depleted as the result of the disease that it is necessary that the fluid contents of the body be kept up. A continuous normal saline solution given rectally has proved of value in several cases. In some cases it has seemed best to give feedings by rectum. For this purpose the only food that can be considered is breast milk.

When this is attempted the routine is about as follows: A feeding of ½ to 1 ounce of breast milk is given rectally. In two hours 2 or 3 ounces of normal salt solution; in two hours again the rectal feeding, and so on. There has been with this procedure much less irritation of the bowel than we had expected.

After the Rammstedt pyloroplasty, in contrast to the above conditions following gastro-enterostomy, the ordinary feedings may be continued.

CLINIC OF DR. CARL BECK

North Chicago Hospital

OPEN WOUND TREATMENT OF ACUTE AND CHRONIC BONE AND JOINT INFECTIONS: CLINICAL TALK WITH DEMONSTRATIONS OF THREE CASES

Summary: (*a*) Extensive tuberculosis of elbow-joint with bone destruction—resection of all diseased tissue, wound packed wide open, no suture, healing with but little deformity and satisfactory mobility.

(*b*) Neglected felon—open treatment—recognition of dead bone at operation.

(*c*) Osteomyelitis of jaw secondary to infected molar; open treatment.

Philosophy of the open wound treatment—disadvantages of gauze and tubular drainage—adhesive plaster to promote growth of skin over raw surfaces—results obtained by Dr. Alexis Carrel in the military hospitals of France.

The cases which I am presenting to you are illustrative of a method which is not universally used, but which is very successful in the treatment of bad acute and chronic inflammations of joints and bones.

This patient, an Armenian, eighteen years old, has been in this country only a short time, working as a factory hand. Although living in a very healthy climate of Armenia, he was afflicted in his youth with a number of boils, and has had several small operations for the same in his home country. He does not remember that he ever had any important or severe malady. He uses neither alcohol nor tobacco, does not cough, does not perspire at night, but has lost considerable flesh, especially during the last two years since his present trouble began. He worked then in a barbers' school, learning the trade for two months, when his elbow began to swell. He went to a hospital, where the elbow was incised; pus discharged. At the same time a swelling of one of his ribs appeared, which also was incised and pus discharged. Part of the rib was removed. The wound on his chest healed perfectly, but the arm never healed. Another operation like the first one was performed. His arm, however, began to swell more and more in the elbow region; it became stiff at an angle of about 70 degrees, and while it did not pain very much, the constant suppuration brought his health down to such a point that he was sent to the hospital for incurable tuberculous patients at Oak Forest. There an amputation was proposed above the elbow, but was refused, whereupon his physician sent him here for consultation and treatment.

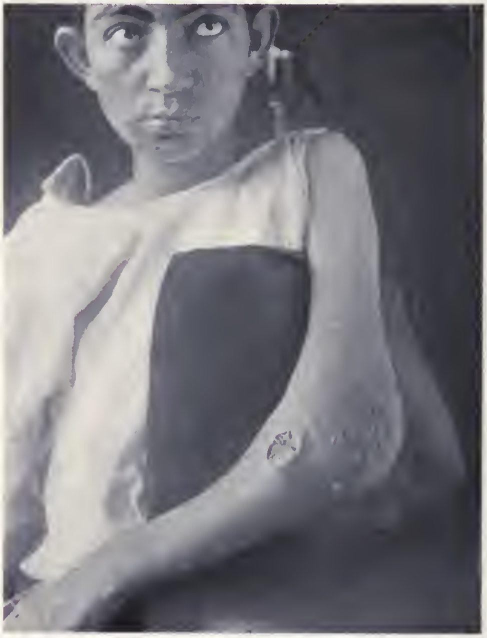


Fig. 49.—The arm as it came under our observation; draining fistulæ and ulcerated surface seen.

The idea of the doctor in sending him was that possibly through the use of bismuth paste or some other means the arm might be saved. At first glance this seemed hardly to be hoped for. The elbow was enlarged to considerable size, the skin glistening and congested. There was a thin discharge mixed with a few flakes of pus, while dead tissue and some anemic granulations were seen protruding from a number of fistulous openings. The arm had lost its motility and the muscles were atrophied from non-use (Fig. 49). The lungs and heart seemed to be normal, but the boy's general condition was pretty bad.

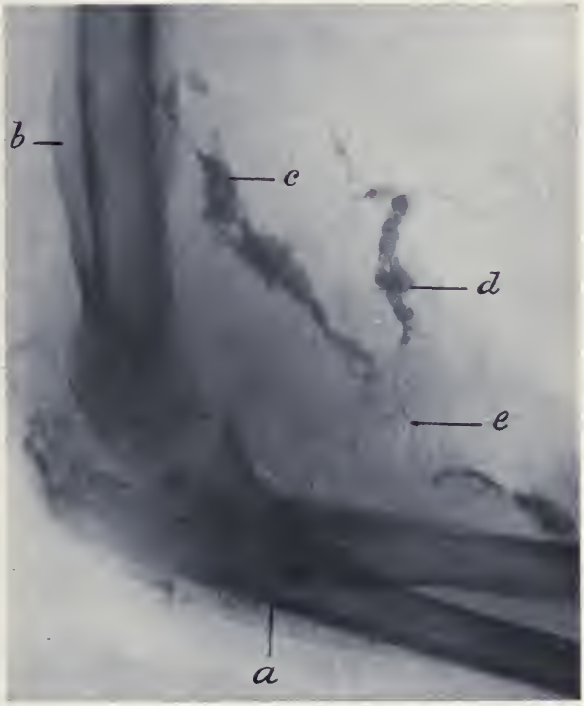


Fig. 50.—Elbow injected with bismuth paste, showing the different directions of the fistulæ connected through the bismuth paste. The bone lesions are also well shown.

The *x*-ray pictures at that time, following the injection of bismuth paste, showed the elbow-joint destroyed (Fig. 50); the process of the disease having produced an absorption of a great deal of the bony substance in the humerus, radius, and ulna, associated with areas of new bone formation (*a*), and marked thickening of the periosteum (*b*). The changes at *a* and *b* remind one of the possibility of syphilis (syphilitic periostitis), but are not to be regarded as characteristic of that disease. Fistulous tracts, as demonstrated by the shadows of the masses of paste (*c*, *d*, *e*), are seen running in different directions through the granulomatous tissue. No sequestrum of distinct character can be distinguished.

A Wassermann reaction was double plus result with two control tests; nevertheless there were no other syphilitic symptoms present, and large doses of potassium iodid did not bring about any improvement.

Operation November 17, 1915: After applying an Esmarch constrictor an incision was made over the external surface of the elbow long enough to expose the whole pathologic process; by a forced flexion the joint was immediately opened and all the nooks and corners of the diseased bone exposed. With a sharp spoon and with cutting forceps everything that seemed diseased was removed, including part of the radius and a good-sized piece of the end of the ulna, while the ulna was rounded off clear down to healthy tissue. This left quite an extensive wound, which was enlarged more by a transverse incision of the skin so as to expose every possible focus. The wound was packed with gauze and bandaged tightly.

There was very little secondary bleeding through the bandages. The large surface covered itself very soon with granulations which looked ugly for some time, because the necrotic portions of the bone were sloughing superficially and some of the soft tissues also (Fig. 51), but gradually began to look healthier, and after a few months of steady improvement the wound healed. Motion began to set in, and now, except for the scar, the elbow appears perfectly normal.

As an illustration of a second case treated in the above manner I present this patient, a young working girl of twenty years, who about a month ago contracted an infection of her right thumb, which later developed into a felon. This felon was incised and a quantity of pus escaped. The incision did not heal, but has continued to discharge pus ever since.

The *x*-ray pictures made at this time show a ragged, dull end-phalanx. A probe inserted into the wound impinges upon rough, bare bone. Our diagnosis, therefore, is a necrosis of the phalanx.

This case is representative of many similar cases. They are, as a rule, self-limiting, but it takes a good long while to exfoliate the dead tissue. It takes, in the first place, a good long time, perhaps weeks, for the separation of the dead and healthy bone and the escape of the former; the dead soft tissues slough out in little particles which are washed out daily, and when the process clears up the skin closes over that wound with a retracted scar and the nail grows like a claw over the end of the thumb.

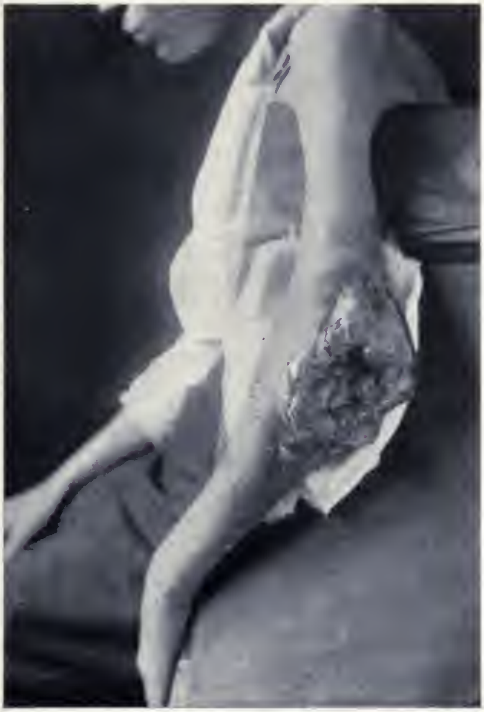


Fig. 51.—Wound at the first dressing, open, showing the extent and the drainage; the bones exposed in the center.

Every surgeon is familiar with this result of a felon of the thumb in particular, but also of the other fingers. The procedure to cut that healing short, which is of great importance for this patient, is the open treatment quoted above. We cut the thumb, open the wound wide, and expose the bone. Is this bone dead? We take a cutting forceps and cut off the end of the phalanx. We see that the cut surface is white and dry. We cut a little more, and we see here and there a bleeding point, but most of the surface is dry. We cut still a little closer to the first joint, and we find that the bone is bleeding. That is healthy bone. We stop cutting away now, clean the wound of its granulations, and pack it with gauze. We shall expect this wound to granulate and heal quite promptly.

A third illustrative case is that of this young man with a necrosed jaw, which necrosis has its origin in an impacted wisdom tooth. An abscess developed here, which was opened and drained by a physician, but as there was no attempt made to remove the diseased or dead bone the abscess recurred each time the drainage opening healed over.

Today we enlarge this opening on the side of the face clear down to the necrosed bone and remove it with the impacted tooth. Now the whole cavity produced by this operation is packed with gauze, as in the other two cases. The packing will be renewed at intervals and the wound will be made to heal from the bottom up.

It is important, first, to remove the whole pathologic process; second, to provide a sufficient external opening; and, third, to maintain the external wound open by gauze packing changed at appropriate intervals until the whole cavity has filled in from the bottom. We have followed this procedure in a large number of cases of osteomyelitis of the long and short bones and in connection with many diseased joints, and we regard the results as highly satisfactory.

The history of the cases which come to us is always the same. The first physician whom the patient consults assists nature by making some incisions, short and insufficient, to give the pus a chance to discharge from the body. I always compare these conditions to a bottle, the incised wound being the neck, and the deep-lying pathologic process the belly of the bottle. Through such small openings many surgeons try to remove pathologic tissues with spoons and irrigations, without ever being able to look into the wound and so assure themselves that the dead tissue is removed in its full extent. They can work only in the direct line of their spoon and cannot get around corners, and therefore they frequently leave cavities, recesses, and pockets, with the resultant fistulæ. Bolder and more progressive surgeons open such wounds, expose them thoroughly, remove all the pathologic tissue which they can find, but they close up the surface, leaving only one or two points of exit for those tissues which become necrotic after the operation, or which, though necrotic, might have been left behind. In many instances, especially where the process has been relatively acute, this method will lead to perfect success. Every once in a while, however, infected tissue will be enclosed by the rapidly healing skin, and then look out for fistulæ.

In quite a number of cases in which one or several operations have been performed with the removal of dead or diseased tissue, fistulæ have remained. These we have treated by the injection of bismuth paste, which has led in many instances to permanent closure. The function of the paste in such cases seems to be that of assisting in the filling of the cavities, which could not otherwise be obliterated and which would have drained until obliterated.

The method which we employed in the case of this young Armenian is, in my estimation, the only safe way of dealing with such extensive cases. Tubes or gauze as safety-valves and as drainage routes have many disagreeable features. They often allow incomplete discharge, the damming up of the discharges causing retention with fever, because gauze and tubes cease to be capillary or hydrophil when they are clogged up with material. We often find when we remove these drainage-tubes or strips of gauze that the fluid which has been dammed up behind them escapes in a gush, and the patients, who have been running a temperature, become free of fever and pain. The appearance of healthy granulations on such large wounds is the only proof of their health and the absence of any disease behind them. One should, however, not be deceived in this, as granulations grow very rapidly and often cover a hidden sinus, but they never close entirely and permanently if there is such a disease behind them. We observe rather that in some spots in which the opening is not very clear there is an appearance of some pus or serous discharge, and if we closely examine these spots we will find that they often lead to a hidden sinus. This is all a matter of experience and close observation.

Occasionally, after the cavity has filled in, we will be confronted with large skin defects, which, left to themselves, may take weeks to heal. In such instances we can skin-graft or, still better, we can use a method which has given us a great deal of success, namely, the use of adhesive plaster, under which epithelization takes place very rapidly. This is a new method which is not universally known, but which has been used extensively in this city by Dr. Charles A. Parker[1] and others in the treatment of granulating surfaces, especially those following burns. It seems that the adhesive plaster prevents the elevation of the granulations over the borders, and that it keeps the epithelium propagating or growing better from the border, so that under the adhesive plaster new epithelium rapidly grows out over the granulations, covering the defect in a relatively short time.

Incidentally, I may say that this method of open treatment of large wounds of this character may also be applied very satisfactorily to fresh wounds, such as appear now in large numbers as a result of the present war. I am in close communication with my former associate and friend, Dr. Alexis Carrel, who holds a position in a hospital in Compiègne, France, close to the front. Connected with the hospital is a small institute of research modeled after the Rockefeller Institute, in which he has been an active worker. I have sent him pictures of my experiences with open wounds, and have received from him reports of his very extensive experiences in the treatment of wounds caused by shrapnel, explosives, and other methods of warfare. The wounds of bones and joints which come to him are almost invariably infected. Carrel lays these wounds open and irrigates them continuously with Dakin's solution until they become perfectly sterile. He has kept close watch on the number of bacteria to the unit, and has mathematically ascertained that these infections grow from day to day less in quantity until they disappear entirely. He can then by the curve (Fig. 52), by which is recorded the results of the daily investigation, judge the nature of the wound and the possibility of early closure. In acute processes of this kind I think his method is excellent. In chronic processes, such as those with which we have dealt today, I think Carrel's method of investigation and treatment would be of no value. We know that such wounds remain infected until the last day of closure, and that the granulations which have developed have finally become so resistant that we could even put a culture of infectious material right upon their surface and it would do no harm.

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[1] Parker, C. A., Jour. Amer. Med. Assoc., 1915, lxv, p. 14.

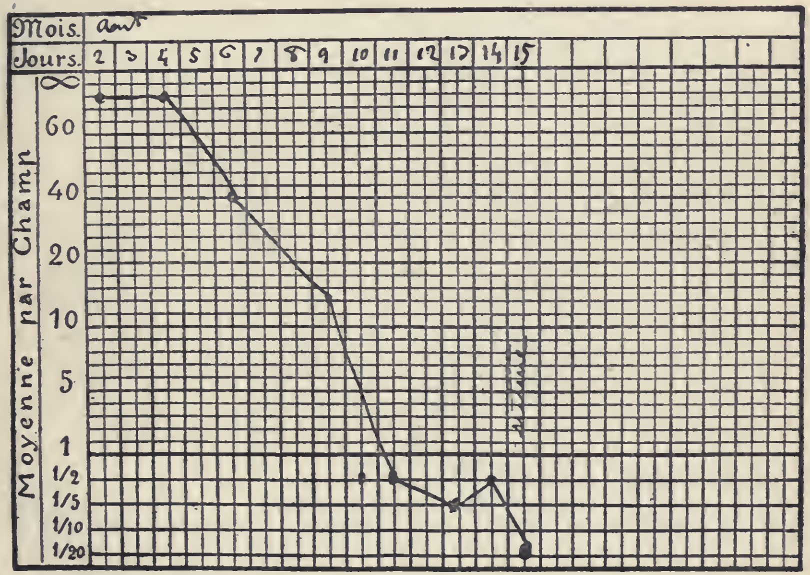

Fig. 52.—This curve, prepared by Dr. Alexis Carrel, has been sent to me to show the falling off in the number of bacteria in the wound while under treatment. Treatment by irrigation with Dakin's solution was begun on August 2, 1916. On August 15th the wound was bacteria free.

NEW TREATMENT OF LARGE CAVITIES AFTER EMPYEMA OF THE CHEST: DEMONSTRATION OF A CASE AND CLINICAL TALK

Summary: History of patient—failure of Estlander-Schede operation; Dr. Beck's operation; causes of persistent empyema cavities; diagnosis with *x*-ray and bismuth paste; complications; danger of the "suction" treatment; treatment of bronchial fistulæ; Dr. Emil Beck's method; cases suitable for the Schede and Estlander operations; importance of leaving portion of chest wall posteriorly when doing radical operation for cure of large cavities following empyema.

Miss F. L. at age of four had measles and pneumonia, with pleurisy; at the same time had an attack of appendicitis. Was fairly well up to the age of nine, when she had again an attack of pleurisy followed by empyema. This was operated upon and drained. The drainage was kept up until she was fourteen years old, at which time it closed. She had fever again for five weeks. The cavity on right side was opened again, pus discharged, the wound healed, but a month later closed again, had fever, and wound opened once more. When wound closes she has fever and chills, and when it is draining she feels well with exceptional coughing spells.

Patient's condition in May, 1915: Fever, 102° F.; retention of yellow, thick pus which drains only through a very small opening; *x*-ray examinations show the right chest cavity almost entirely filled with pus, the lung very much retracted to a small, dense, flattened tissue around the apex. A large incision is made alongside the sixth and seventh ribs, a portion of these ribs excised and a drainage-tube inserted (Fig. 53). This condition, however, does not improve the general status. Patient, while gaining in weight on account of the free discharge, has no tendency to obliterate the chest cavity (Fig. 54).

In February, 1916, an extensive operation was performed, all the ribs were removed up to the third in front and to the axillary line (a modified Estlander-Schede operation).

March 10, 1916, fluoroscopic examination showed the chest cavity empty, a good excursion of the diaphragm, but the lung not expanding. The wound was closing externally, but the chest cavity was not improving and not getting very much smaller.

May 10, 1916, an extensive operation was performed by removing the right breast gland, and the whole front part of the skin of the chest wall turned inward as a flap to cover the raw surface of the chest cavity as far as it reached; a packing kept this flap in apposition. Eight days afterward packing was removed, the flap stuck closely to the raw surface, and from this time on the chest cavity was treated like an open wound and allowed to cicatrize and granulate. Adhesive plaster was used to cover the wound surface in order to make it heal by epidermization very rapidly underneath the plaster.

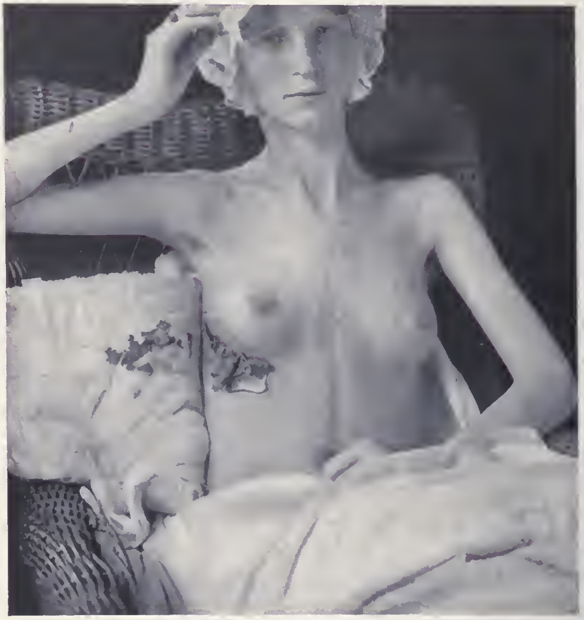

Fig. 53.—Appearance of chest after operation in May, 1915.

Today (November 17, 1916) the chest cavity is almost entirely cicatrized and the patient will have a full scar formation very soon, with normal action of the left lung, a visible pulsation of the pericardium, and visible excursion of the diaphragm. There is no discharge of any kind from the wound surface and the patient is very rapidly recovering (Fig. 55).

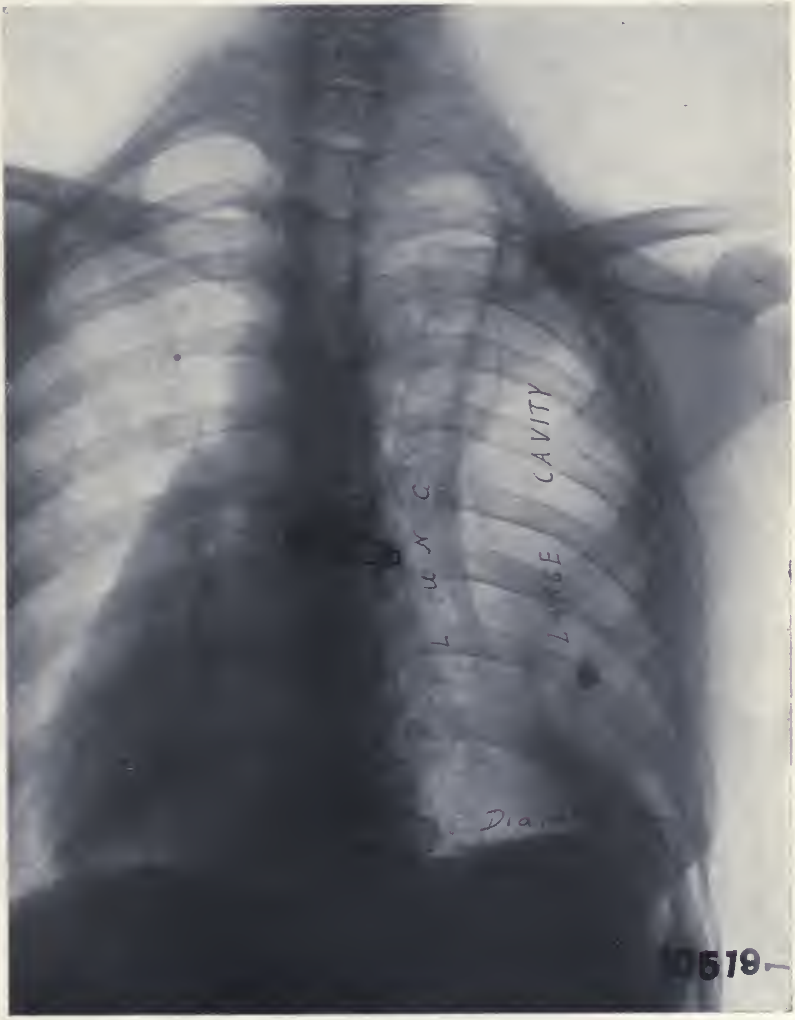

Fig. 54.—*x*-Ray picture of the case following the operation of May, 1915, showing the large cavity of the chest, the lung retracted, and the diaphragm higher on the affected side.

Chronic suppurations from intractable empyema of the chest are quite common. The patients have become used to their trouble, and if the balance of the loss through suppuration and their gain through nourishment and good hygienic condition is in favor of the patients they get along very nicely with such a chronic suppuration.

I have seen cases which lasted fifteen and twenty years, and have grown so accustomed to their tube and their discharge that they do not find it any discomfort and would be unhappy without it, but that is not the case with the majority. Most of the people, if they have no discomfort, feel much annoyed by the constant pus discharges, which at times have an offensive odor.

Can we cure these cases? There have been many attempts made by surgical and non-surgical methods to obliterate these cavities. Let us ask, What is the cause of these chronic suppurations? The first cause is a mechanical one, namely, that the wall of the chest and the surface of the lung, once receded from contact of each other, become stiff and rigid so they cannot come together again. The surgeons have tried in these cases to make the chest wall movable or make the lung movable. Hence the Estlander-Schede operation and a score of modifications of the same; also the operation of pneumolysis is one which has been tried with good success at times and at times with poor result. Another very ingenious way has been suggested by Tuffier, namely, to implant large pieces of fat, taken from a patient, into such cavities after the costal pleura has been separated. I have tried to imitate this method by using in this particular case the breast gland, which was quite large, to fill out that cavity, but without success.

The second cause of these chronic suppurations is an essential disease. There are individuals who have such cavities as the results of tuberculosis. The cavity is never free from tubercular deposits, and hence, unless these deposits are cured, the tubercular process does not allow closure.

The third and probably the most common cause is the opening of this cavity into a bronchus, a so-called "bronchial fistula," which makes this cavity of the chest communicate through the

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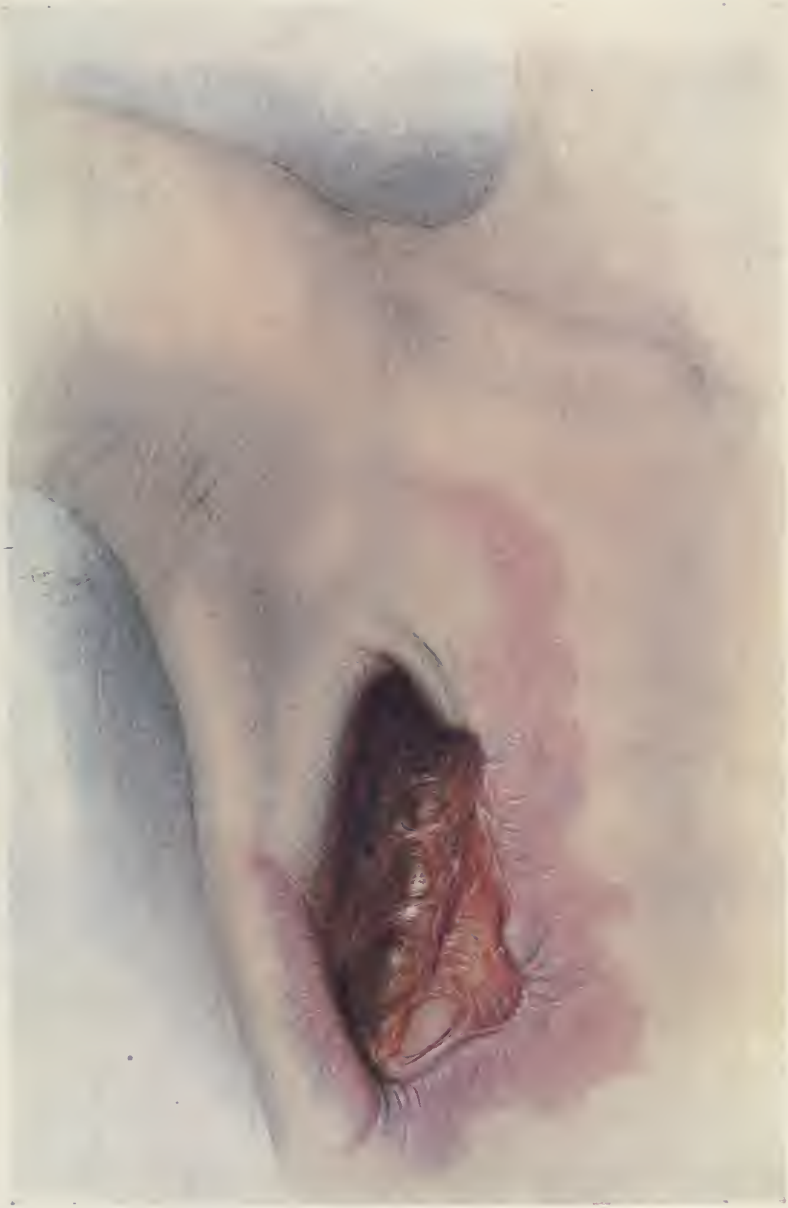


Fig. 55.—Appearance of chest at present writing. Healing well advanced

bronchus with the outside, so that there are present two openings —one into the lung and one toward the outside. A combination of bronchial fistula and tuberculosis is also very frequent. Nature tries to accomplish the diminution of the cavity in many ways. The diaphragm is pulled up, as we can see distinctly in *x*-ray examinations (see Fig. 54); the spinal column curves toward the affected side, with the effect of diminishing the size of the cavity; the chest wall sinks in and the ribs take on a more angular shape instead of a curved shape, also diminishing the size. All these natural supports of the healing process have been increased by the surgeons when they tried to obliterate such cavities.

The diagnosis of such cavities is, in our times, comparatively easy. The *x*-ray, with or without bismuth injection, solves this question absolutely. We can at once find out how large the cavity is and how it is shaped by stereoscopic pictures, and we can also find out whether a communication exists between this cavity and the bronchus. When we inject bismuth paste in these cases in most instances the patients cough up the bismuth just as soon as we inject it. When this happened in the first few cases, and the patients became cyanotic and had some spastic cough-attacks after the injection, we were somewhat alarmed, but this does not worry us now because we have found that the injection is not only harmless, but often clears away lots of pus and mucus.

The conditions are not always as simple as indicated in the preceding pathologic outline. For instance, a spinal abscess which has broken into the chest cavity and produced an empyema without any affection of the lung, but with the deviation of the spine, due to the bone process in the same, will be a very interesting study. If there are fistulæ leading to the skin from the spine, and if they are injected, it may often happen that the paste runs out through the chest opening when the spine is injected, or vice versa. We have even seen paste injected into the spine come out through the lung in the presence of an associated bronchial fistula.

Recognizing the occurrence of unusual conditions such as the preceding, I would say that the majority of old empyema cavities are of a plain character, and the closure of the cavity is not possible purely on account of the mechanical impossibility of approximation of the two surfaces, the chest and the lung.

When treating these cavities we have tried to make the lung movable through suction. Getting the air out of that cavity was not hard, but we have often seen hemorrhages follow such suction. Those granulations in the chest, when sucked upon by this method, are apt to bleed profusely, and such bleeding is hard to stop. I recall a case of a young boy in whom we had such profuse hemorrhages that we were quite alarmed. They filled the chest cavity with blood, and we stopped the hemorrhage by plugging up the hole in the chest wall until the pressure within became equal to the pressure of the blood-stream and coagulation took place. Then the boy began to develop high fever. The blood-clot became highly infected and caused very disagreeable symptoms.

If we can close the opening in the bronchus we often can get the cavity to close spontaneously, and, therefore, in the bronchial fistula cases most of our efforts are directed to the closure of the bronchus. We cauterize the opening in the bronchus with the actual cautery; this has occasionally diminished the size of the opening. In the presence of two or three bronchial openings the cauterization has been done on all. The smoke from the cauterization is very unpleasant for the patient, and makes him cough a good deal and often disturbs the healing. Nevertheless, we have sometimes produced quite an improvement. I do not recall any case where we could close the fistula entirely by this method. In a large number of cases it has been impossible to get the fistula into the speculum and so within reach of the cautery.

Schede and Estlander operations I have done many times, and I may say I have cured a number of empyema cases in this way, but none of them were characterized by what I would call extremely large cavities, perhaps one-third or two-fifths of the chest cavity being free from lung. When the lung has retracted to a very small shriveled-up flap, lying over the spinal column or retracted into the angle of the apex toward the large bronchi, then the question "how to close this cavity" becomes very pertinent.

My brother, Dr. Emil Beck, has for some time tried to close bronchial fistulæ by cutting out a flap from the skin of the chest wall and pushing it into the chest cavity toward the bronchus. In this way he forms a funnel with its apex in the bronchus. This method he has described and shown, and is now writing a special paper on that subject.

I have conceived the idea which you see has been carried out in this patient. Of course, if we remove the whole chest wall, including all the ribs, we deprive the trunk of much support on that side, and the immediate result will be much distortion toward the other side, with difficulty in breathing and interference with heart action. Therefore it is best to leave a portion of the chest wall posteriorly in the shape of a plate of ribs which fall closely together and support the back. They often fall upon each other like the shingles of a roof, covering each other to a certain extent and in that way making a solid wall. The flaps cut from the anterior portion of the chest are folded in, as you see, and gradually grow toward each other in such a manner as to line the cavity with skin and so effect complete healing.

CLINIC OF DR. ALLEN B. KANAVEL

WESLEY HOSPITAL

TRANSPLANTATION OF FASCIA LATA IN EXSTROPHY OF THE BLADDER, COMPLETE DEFECTS IN THE ABDOMINAL WALL, AND SPINA BIFIDA

Summary: Wide usefulness of the transplantation of fascia lata; autoplastic transplants the best; necessity of determining compatibility of tissues before making transplants from donors other than the patient himself—agglutination test probably sufficient; an aseptic, vascular field desirable site for transplant; fate of fascial transplants.

Case I. Exstrophy of bladder with double inguinal hernia; the Segond operation; value of fascial transplant; results; comparison of this treatment with other methods.

Case II. Complete defect of abdominal wall; huge postoperative hernia in a woman thirty-five years of age; method of repair with fascia; types of defects of the abdominal wall in which it is desirable.

Case III. Spina bifida; two questions to be considered in the treatment; technic of operation; when to operate; prognosis.

November 6, 1916.

THESE cases are presented with the idea of emphasizing the value of fascia lata in repairing defects which would otherwise not be amenable to plastic procedures. They are chosen because they illustrate some of the rarer forms in which this method of cure is of avail. The commoner pathologic conditions in which transplantation of the fascia lata is done are well known to the profession, such as repair of the ordinary herniæ and cranial defects, tubulization of nerves, etc. That it has a wider application than this no one can doubt who has had experience in surgical work. I have transplanted fascia in more than 60 cases with marked success, as will be mentioned later.

In the use of fascia it is probable that autoplastic transplantation is superior to fascia taken from other individuals, and this can be done in almost all cases, although I have used the latter in several patients. When this is done it is advisable, it seems to me, to test the hemolytic action of the blood or at least its agglutinating properties, with the idea of choosing those individuals in whom the hemolysis or cytolysis would not be probable. I believe that the agglutination test, which is more easily and quickly done, is just as satisfactory as the hemolytic test.

It would seem advisable to transplant fascia into areas in which there is a fair blood-supply. It is remarkable with how little blood-supply fascia lata will live, but, on the other hand, a fair blood-supply surely increases the probability of success; I have also attempted in all cases to see that there is a free blood-supply on both sides of the fascia lata flap and have never transplanted two layers in juxtaposition. It is also undeniable that an aseptic field offers the best hope of success. On the other hand, it has happened to all of us to transplant flaps into a septic field or to have the wound become infected without loss of the fascia lata transplant. It would seem reasonable, however, to attribute this to good fortune, and while I would not hesitate in case of necessity to do such a transplantation, I would expect success in not more than half the cases.

As to the fate of these transplants, we do not have a definite knowledge. From clinical evidence they grow in place and remain permanently as a part of the tissues. We do not have experimental evidence, however, to support this assumption, and it is entirely possible that the fascia transplants are replaced by scar tissue. But if this be so, the resulting tissue must differ from ordinary scar tissue, since we have clinical evidence that it does not stretch and lose its vitality as does such tissue. It is probable that fascia placed in such positions where the tissue is under strain, as in the muscular tissue or abdominal wall, will retain its function better than when transplanted into protected areas such as the dura.

The fascia is best procured from the fascia lata. It can be removed here without interfering with the function of the leg, and after it is removed the edges of the defect thus produced are drawn as closely together as possible by catgut sutures and the remaining area allowed to scar over underneath the closed skin.

When transplanted into the tissues care must be taken to tack down the edges and corners, since, if not so treated, the flaps have a tendency to roll up and become displaced.

CASE I.—EXSTROPHY OF BLADDER WITH DOUBLE INGUINAL HERNIA

The first case here presented, that of Mr. J. M., Wesley Hospital, No. 45,113, entered the hospital January 9, 1914. He was twenty-six years of age. He presented the typical appearance of an exstrophy of the bladder and an epispadiac penis (Fig. 56). The bladder wall exposed measured 3½ inches in width by 2½ inches in height, corresponding to the defect in the abdominal

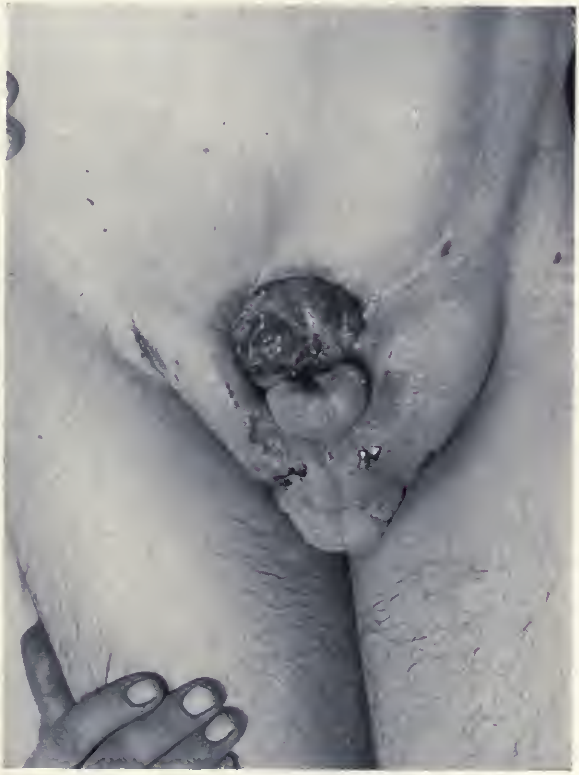


Fig. 56.—Photograph of exstrophy of bladder before operation.

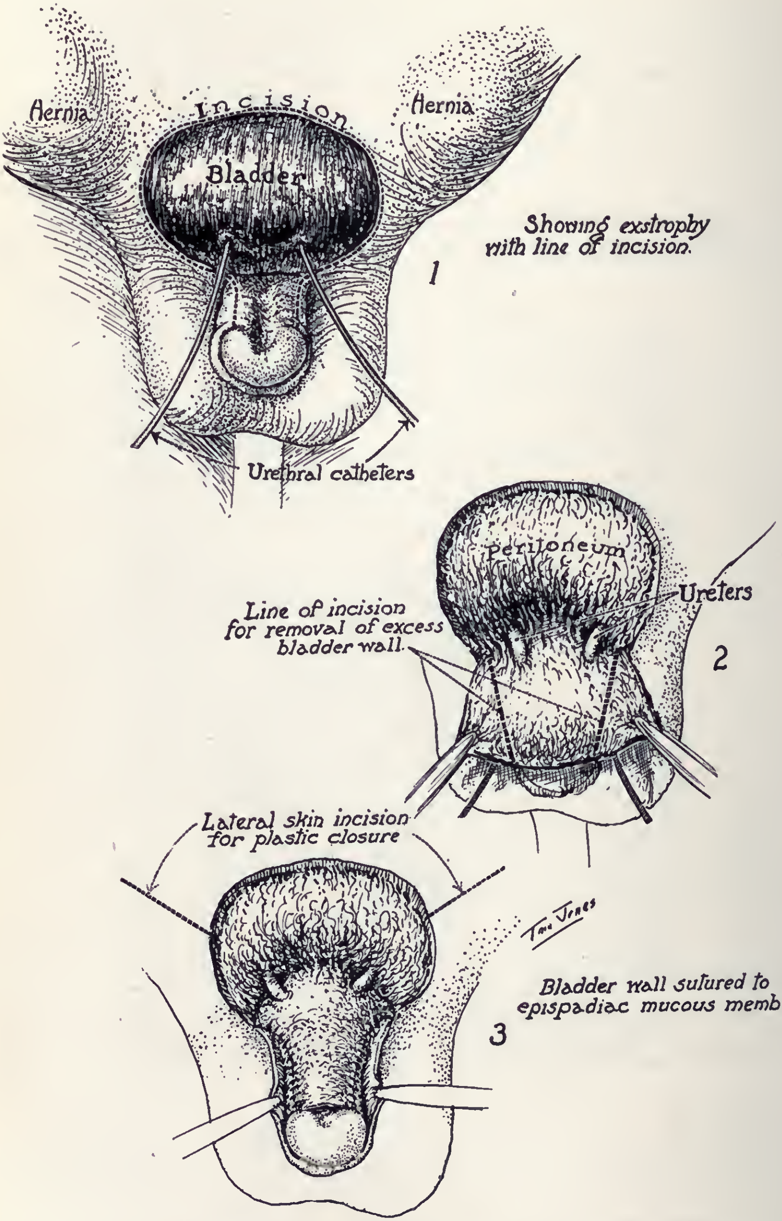


Fig. 57.

Figs. 57, 58.—Drawings showing steps of modified Segond operation as described in the text.

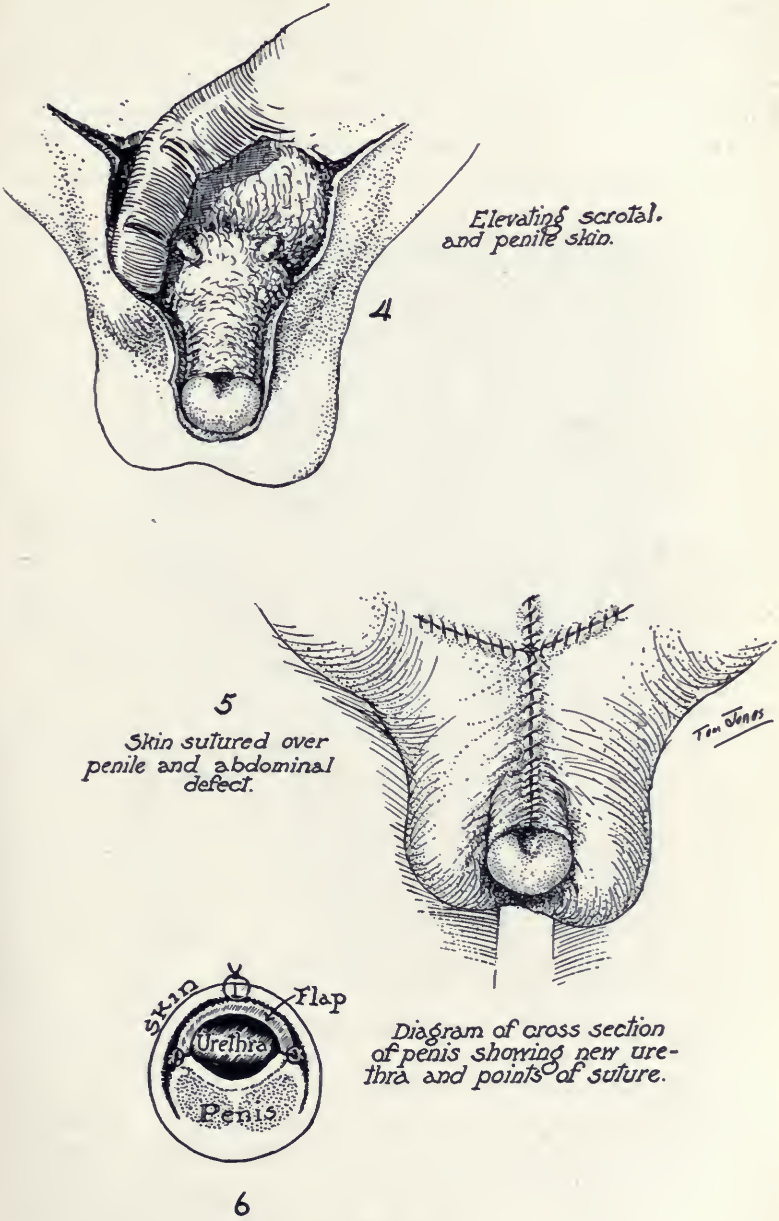

Elevating scrotal. and penile skin.
4
5
Skin sutured over penile and abdominal defect.
Tom Jones
Skin
Flap
Urethra
Penis
Diagram of cross section of penis showing new urethra and points of suture.
6

Fig. 58.

wall. He also had a separation of the symphysis pubis of 8 cm. and a double inguinal hernia. Catheterization of the exposed ureters showed there was apparently no pyelonephritis. The general physical examination is omitted, since it was negative.

This case, in brief, presents the typical picture seen in all exstrophies of the bladder. The congenital defect of the symphysis is a necessary adjunct of the exstrophy, and the double inguinal hernia is also a practically constant accompaniment of the condition.

He was operated upon in two stages. At the first operation the exstrophy of the bladder was cured, and at the second operation the double inguinal herniæ were repaired. The method of operation chosen was a modification of the Segond operation, to which was added the transplantation of a flap of fascia lata to cover the defect in the abdominal wall and the repair of the herniæ at a subsequent operation. The operation was performed as follows:

Ureteral catheters were placed in the ureters to identify them, and the bladder wall, with its mucous membrane and musculature, was separated from the skin throughout its circumference, and with a sponge the peritoneum was pushed off the posterior surface of the bladder down to the ureters (Figs. 57 and 58). These were then freed for a distance of 1 inch from the base of the bladder, care being taken not to remove the tissue immediately adjacent to the ureters so as not to injure their blood-supply or their lymphatic connection. The lateral edge of the bladder, as shown in the sketch (Fig. 57, 2), was then excised. Incisions connecting the lateral incisions between the bladder and skin were then continued down the lateral dorsal surface of the epispadiac penis and the mucous membrane slightly raised. To this the mucous membrane on either side was sutured by interrupted catgut sutures, the cut lateral edges of the bladder allowing the base of the bladder to remain back of the penis (Fig. 57, 3). The skin of the scrotum and the abdominal wall was then dissected up, including the excessive skin of the prepuce, as shown in the sketch, and drawn over the dorsum of the penis, being sutured down the median line (Figs. 57 and 58). Two lateral incisions on the abdomen, from the cut edge of the defect in the skin, served to allow a more easy apposition of the skin over the lower portion of the abdomen and permitted a complete covering of the defect.

This operative procedure was followed by satisfactory results as far as the exstrophy of the bladder was concerned. At the removal of the stitches it was noted that the skin separated $\frac{1}{4}$ inch for a distance of $\frac{1}{2}$ inch on the dorsum of the penis. The remainder of the wound healed perfectly. This was rapidly covered by epithelium, and the patient was discharged twenty-five days after the operation with the wound entirely healed (Fig. 59).

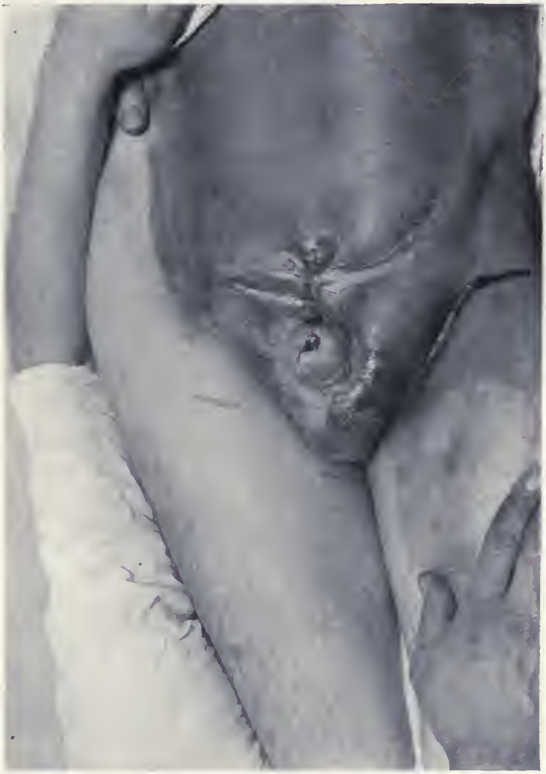


Fig. 59.—Photograph of patient three months after cure of exstrophy.

He returned to the hospital for the second operation in three months, at which time the hernias were operated upon in general by the typical Bassini method; that is to say, the external oblique was incised and the cord elevated, the congenital peritoneal sac excised, and as far as possible the conjoined tendon drawn down to Poupart's ligament. Unfortunately in these cases, in common with some other types of hernia, there is a considerable defect at the lower end of the inguinal canal, in that the conjoined tendon does not meet the separated pubic bones, thus leaving a defect which cannot be covered in by the ordinary closure in many cases. It is remembered that we also have a defect in the abdominal wall through which the exstrophied bladder appeared. A flap of fascia lata 3 inches in width was taken and transplanted into the wound, the skin over the central abdominal defect being separated from the underlying peritoneum. The flap was then inserted underneath the external oblique, passed through an incision made at the edge of the exstrophy defect, thus separating the external oblique from the internal oblique, the flap then being drawn across the central defect was passed underneath the external oblique of the opposite side through a similar incision, to be attached behind the cord to Poupart's ligament on the other side. We thus had a flap of fascia lata passing from Poupart's ligament on one side to Poupart's ligament upon the other, its upper edge being attached to the upper edge of the defect, and lying underneath the external oblique on both sides and the skin in the median line, and having behind it the internal oblique on either side and the peritoneum with the remains of the bladder in the central portion. It is thus seen that the remains of the bladder were partially held in the abdominal cavity by the fascia flap and passed out to join the penis underneath its lower edge. The cord was then laid upon the fascia transplant and the external oblique sutured over the remainder, the operation being a typical Bassini. The position of this flap will be seen by examining Fig. 60. The exstrophied condition and the results after the operation will be seen in Figs. 56 and 59.

The immediate result of this operation was unfortunate, in that an infection of streptococcic nature ensued in the left side, and we were very fearful that the flap would be lost. The infection gradually subsided and the temperature was normal at the end of one week. The wound healed, and the patient left the hospital at the end of five weeks with the wound entirely healed and no evidence of difficulty.

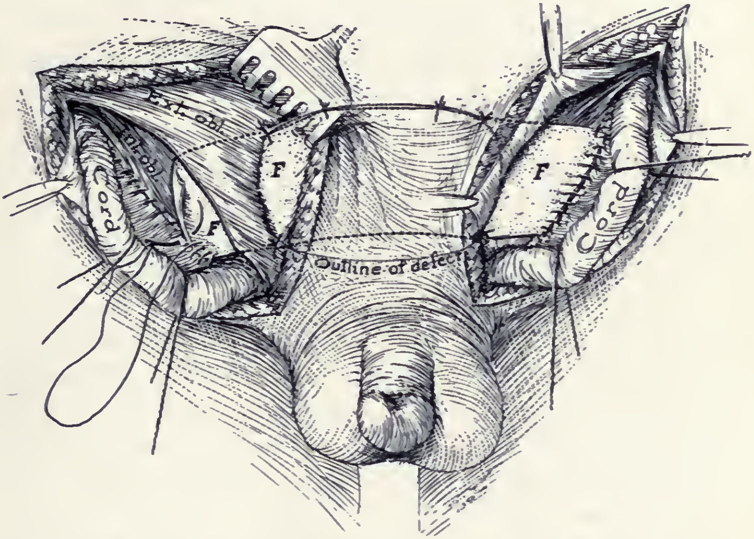


Fig. 60.—The transplantation of the bladder as shown in Figs. 57 and 58 leaves a large defect, closed merely by peritoneum and skin. In addition to this defect there is a bilateral inguinal hernia demanding attention. In this figure the inguinal canal on each side has been exposed, the cord elevated, and we see that the border of the internal oblique muscle has been stitched to the shelf of Poupart's ligament. A strip of fascia (labeled *F*) has been stitched to Poupart's by one end and the other end has been carried beneath the external oblique aponeurosis across the defect, passing between skin and peritoneum, and beneath the external oblique of the opposite side to be stitched to the corresponding ligament of Poupart, thus restoring, to some extent, the integrity of the abdominal wall.

The patient was examined again in July, 1916, one and one-half years after the first operation, and it was found that the hernias had not returned, that there was no excessive bulging through the old defect in the abdominal wall. The patient when lying upon his back in bed could hold his urine during the entire night. When in an upright position, however, there was incontinence, with this exception, that for one-half to one hour after expelling the urine by intra-abdominal pressure no urine would appear. The urinal, of course, fitted satisfactorily over the penis, which was about 2 inches in length. No exstrophy or evidences of difficulty within the bladder were evident.

This method of treatment presents the advantage of curing defects in hernias and central abdominal defects. While curing the exstrophy with a minimum of danger to the patient, it leaves the misfortune of an incontinence of urine, although somewhat mitigated by the fact that if the patient sleeps upon the back the urine can be retained. Other methods of treatment which attempt to restore the sphincteric action universally present a more satisfactory control of the urine if they are successful, but unfortunately add materially to the risk to the patient. The Maydl operation has a mortality of practically 25 per cent., and the Bregenhem, which in many regards is the most ideal procedure, a mortality of 15 per cent. upon the reported cases, and, of course, it is probable that many cases are operated upon fatally which are not reported. The methods of Coffey, Makkas, and many others, having in general the idea of turning the urine into the intestinal tract, all have added risks and with more probability of an ultimate pyonephrosis and death. On the other hand, if they are successful and if the patients remain well, their condition is better than it would be following the operation I have just described. The implantation of the ureters into the skin of the loin is inferior to the method here described. Diakonow, Lerda, and others form a sinus from the bladder through the perineum between the sphincter and rectal mucosa, Diakonow lining it with bladder, and Lerda with skin and Thiersch grafts, thus obtaining some control without the danger of infection starting from the gut. These operations have not been done long enough or in great enough numbers to make a statement as to their value. Trendelenburg and Albarran and others bring together the pubic bones, first, by cutting the sacro-iliac ligaments, and, second, by cutting the pubic ligaments and the ischiopubic bones, a procedure out of proportion to the value obtained. If skin is used to cover the defect in the anterior wall of the bladder, phosphatic deposits and calculi develop upon the area, so that method should be abandoned. We should always bear in mind that excessive traumatism to the ureters should be avoided, since Sweet, Schultz, and many others have shown that infection of the kidney in all probability follows along the lymphatics on the outside of the ureters.

CASE II.—COMPLETE DEFECT OF THE ABDOMINAL WALL

Mrs. J., Cook County Hospital, thirty-five years of age. Seven years previous to examination the patient had been operated on for double pus-tubes. Following this drainage was instituted and a hernia in the median line developed. During the last seven years she has been operated upon eight times for the cure of this defect.

On examination she presented a hernia extending from the umbilicus to the symphysis pubis and laterally, apparently taking in the entire abdominal wall. The hernia was 8 inches in diameter at its base and its sac consisted of nothing but thin scar tissue with peritoneum upon one side and skin upon the other. It was evident that there was not sufficient remnants of the abdominal muscles to close in the defect.

On operation a transverse incision was made, the sac entered, and the contents packed into the abdominal cavity. Then the scar tissue with its peritoneum was retained and on either side the remnants of the abdominal muscles were identified. However, they were not sufficient to cover the defect, and when extended as far as possible, left in the central area a defect 3½ inches in diameter. A strip of fascia lata, 4 inches in width and 5 inches in length, was then removed from the left leg. The peritoneum being closed, the strip of fascia lata was inserted underneath the remnants of the muscles laterally and sutured in position, the remnants of the muscles being thus brought over the ends of the fascia lata transplant. The skin was then closed. We thus had the transplant in the central portion bound internally by peritoneum and scar fragments and externally by skin, while its edges and ends were covered by the muscular body.

The wound healed without infection, and at the end of eight months the patient reported for examination, at which time the hernia had not returned, as will be seen by examining Figs. 61 and 62.

This case is reported because of the interest attached to the use of fascia lata transplant to cover in such a defect. We have used it many times in all types of hernias, particularly in ventral hernia and in that type of inguinal hernia in which we have difficulty in closing the posterior wall of the canal. Here it is needed in two types of cases: first, in patients who are excessively obese; second, in those in whom the conjoined tendon does not attach itself to the pubic spine, a congenital anomaly that is not infrequently seen in spite of its absence from the literature. Attention has been drawn to this defect by Dr. Hessert, whose valuable report discloses that it is much more frequent than one would suppose. Here, owing to the impossibility of bringing the conjoined tendon to Poupart's ligament, the defect will persist unless some transplantation of tissue is carried out. Here the fascia lata transplant is inserted from Poupart's ligament underneath

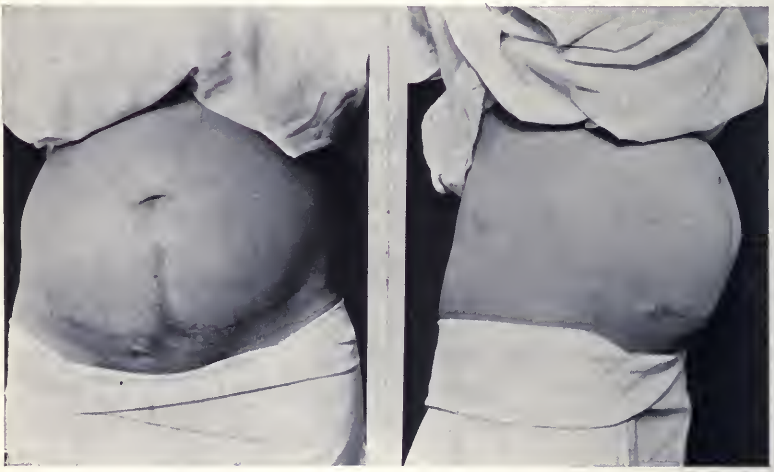


Fig. 61. Fig. 62.

Figs. 61, 62.—Anterior and lateral views eight months after operation. Vertical scar is of the old operation and transverse scar of later operation.

the rectus abdominis to the opposite side, where it is sutured in position to Poupart's ligament and the cord laid over it.

CASE III.—SPINA BIFIDA

The treatment of spina bifida concerns itself with two questions: first, as to the closure of the spinal defect; second, as to the ultimate consequence of such a closure.

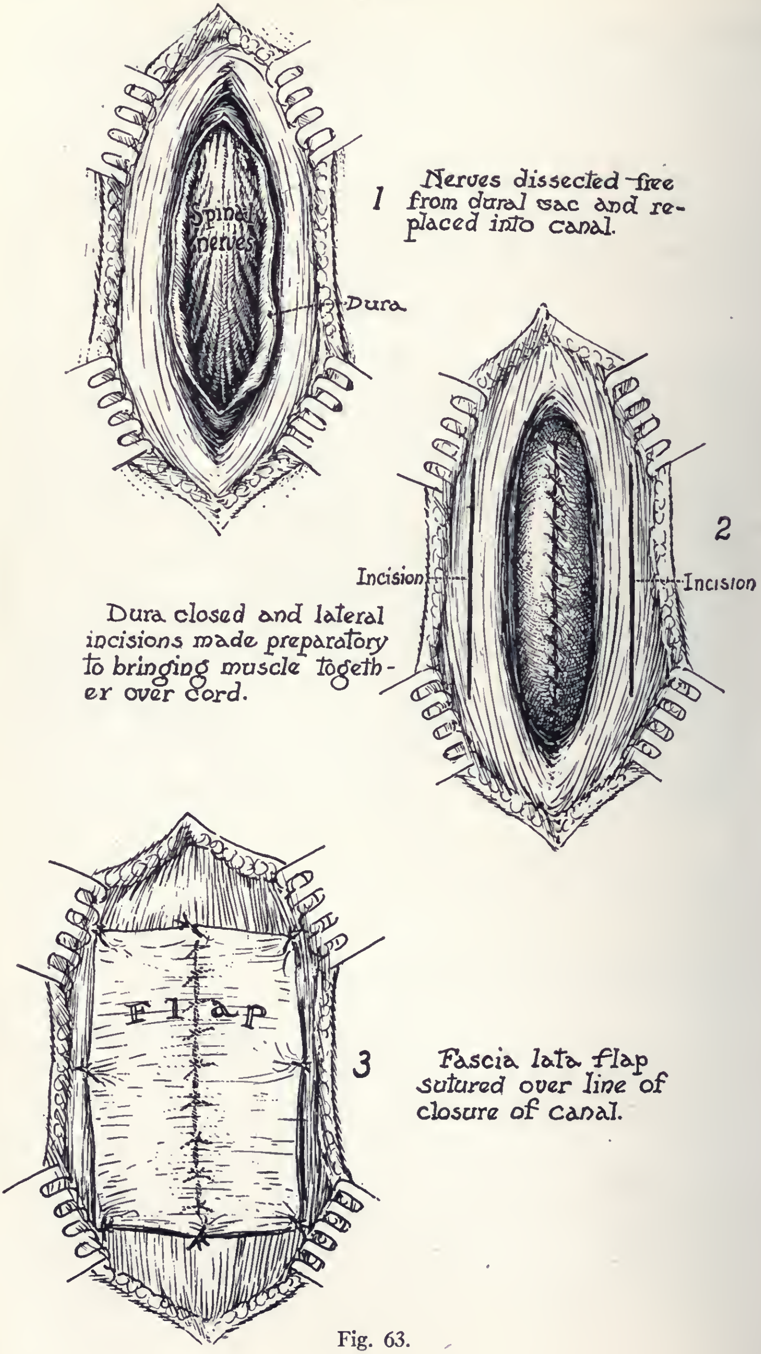
HISTORY

M. F., age ten days, Wesley Hospital, No. 62,586. The child presented a defect of the lower lumbar region involving three vertebræ. The sac was $1\frac{1}{2}$ inches in diameter, clear and glistening in its central portion, with fine capillaries around the edge of the sac. It was so thin that a rupture was imminent. There was some lack of function in the legs.

OPERATION

At operation it was found that the nerves ran through the walls of the sac as well as within the canal. These were carefully dissected off and restored to their position in the canal, the excessive sac removed, and the dura sutured over it, the child meanwhile being placed with his head downward. A lateral incision was made in the muscles at each side of the defect, and this allowed the muscularis and aponeurosis of the adjacent region to be sutured over the dura. This was reinforced by a flap of fascia lata taken from the mother's leg, the agglutination test having shown a lack of hemolysis. This was tacked down by sutures, as shown in the drawing (Fig. 63). The skin was closed over this fascia lata, and a photograph taken at the end of two weeks herewith presented shows a complete cure (Fig. 64).

Examination discloses at the present time, three weeks after the operation, no evidence of return of pressure and no evidence of a beginning hydrocephalus, although it is too early at the present time to say definitely whether or not this will ensue. The mother states that the action of the legs is much more free than it was previous to the operation, and examination fails to disclose any lack of motion in the legs. The child has bladder control



Nerves dissected free from dural sac and replaced into canal.

Dura closed and lateral incisions made preparatory to bringing muscle together over cord.

Fascia lata flap sutured over line of closure of canal.

Fig. 63.

in that there is no dribbling of urine or overdistention of the bladder.

The question arises when to operate on these cases. In the majority of cases it will be found advisable to operate shortly after birth. In my experience an operation within ten days to two weeks after birth is not of great danger. The child is operated upon quickly, with the head downward and the back elevated; no attempt is made at extensive plastic procedures, and the results are very satisfactory. Unfortunately, one cannot say as to the ultimate outcome in regard to hydrocephalus, since a certain percentage of these cases will present this complication later, thus emphasizing the question as to the etiology of spina bifida, whether due to a congenital defect of the vertebral region or due to excessive pressure within the spinal canal incident to perverted physiology of the choroid plexus or other cells.

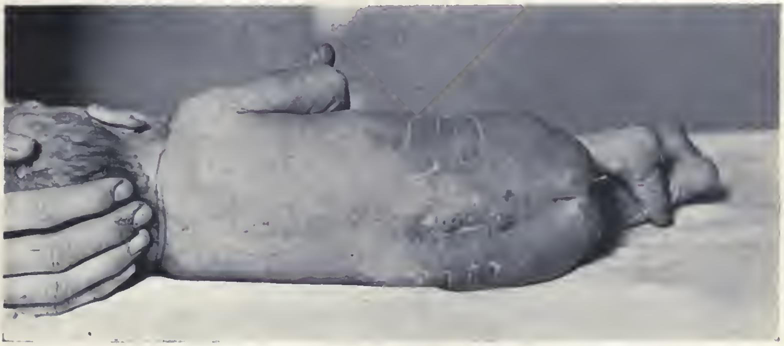


Fig. 64.—Photograph of child ten days after operation.

Fig. 63.—Steps in technic of closure of spinal defect and transplantation of fascia. Note in 3 the precision with which the corners and edges of the flap are sewed in place in order to insure against its rolling up or being displaced. The line of closure of the muscles is shown through the fascial flap.

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CLINIC OF DR. D. N. EISENDRATH

Cook County Hospital

HEAD INJURIES—TWO CASES COMPLICATED BY SYMPTOMS OF INTRACRANIAL INVOLVEMENT

Summary: Necessary steps in routine examination; signs and symptoms of fractured skull; differential diagnosis, treatment, and prognosis of cerebral concussion, cerebral laceration (contusion), and cerebral compression; great value of lumbar puncture in the diagnosis of intracranial injury.

October 20, 1916.

Here are two cases illustrating different forms of injuries to the head. The most important question which arises in connection with such patients is the extent of damage to the various structures which lie within the skull. A few hours' delay in recognizing the presence of hemorrhage from the middle meningeal artery may cost a life which could have been saved by an early diagnosis.

It is our custom in this hospital to disinfect a scalp wound as thoroughly as possible and to examine the underlying vertex of the skull for depressed and non-depressed fractures in every case. A serious injury to the brain and other intracranial structures may, of course, take place without much visible external evidence in the shape of contusions or wounds of the scalp, but this is rather the exception than the rule.

The routine examination of a case of head injury should include the following:

1. Examination of the vertex for evidences of fracture.
2. Lumbar puncture.
3. Radiography (preferably stereoscopic) of the skull.
4. Search for the special signs of fractures of the base (see p. 170).

5. Determination of whether symptoms of (*a*) concussion or, later, of acute spreading edema; (*b*) contusion, or (*c*) compression of the brain are present.

6. Search for evidences of infection in cases after thirty-six to forty-eight hours.

Fractures of the skull are usually divided into those of the vertex (above Reid's base line) and those of the base (below Reid's base line). The statistics of Brun show that 75 per cent. of the fractures of the vertex extend into the base, the middle fossa of the latter being most often involved. There is no longer any sharp line between fractures of the vertex and base because both may be complicated by the same form of intracranial injury. In the past we have been too apt to overlook the evidence of brain injury and to search only for the special signs of fracture. Today we are learning to study our cases from the standpoint of intracranial rather than bone injuries.

The signs of fracture of the base vary according to the fossa which the line of fracture traverses. They are as follows:

I. In fractures through anterior fossa: (1) Hemorrhage into eyelids and conjunctivæ. (2) Bleeding or escape of cerebrospinal fluid or (rarely) brain tissue from the nose or mouth. (3) Loss of sense of smell (a late symptom).

II. Fractures through middle fossa (most frequent location): (1) Escape of blood or cerebrospinal fluid from the ears, rarely of brain tissue. (2) Signs of injury to cranial nerves (second to seventh).

III. Fractures through posterior fossa: (1) Escape of blood from the ear. (2) Subcutaneous ecchymoses on back of neck. (3) Evidence of injury of seventh to twelfth cranial nerves.

One cannot say that the bleeding from the ears is due to a fracture through the petrous portion of the temporal bone until the ear and external auditory canal have been excluded as possible sources of the bleeding. The external ear having been cleansed and examined, I always cover it in cases of fracture with a collodion gauze dressing to prevent infection.

The diagnosis of a fracture of the base is made by combining the results obtained by the search for the special signs just given with the evidence of damage to the other intracranial structures; *e. g.*, the brain, meningeal vessels, sinuses, and the internal carotid artery.

The diagnosis of a fracture of the vertex is easier in many respects. In addition to the inspection of the skull through the retracted edges of the scalp wound we may have the same evidences of intracranial damage as in fractures of the base. Never rely upon the fact that the patient is brought to you with one or more scalp wounds carefully sutured to lead you to exclude the presence of a skull fracture. The responsibility is yours, and no explanations will be accepted if a depressed fracture has been overlooked or the symptoms of intracranial sepsis due to an infected fissured or depressed fracture appear in a few days after you have accepted the opinion of the "first aid" surgeon that there was no injury to the skull, and hence have failed to examine the sutured scalp wounds.

The following table will be of aid in the determination of which form of damage to the brain is present:

	Concussion.	*Laceration (Contusion).*	*Compression.*
1. Time of onset of symptoms:	Immediately after accident.	Immediate, but symptoms at first may be obscured by those of concussion or compression.	Three clinical pictures; *e. g.:* (*a*) No symptoms, then coma; (*b*) concussion or contusion signs, then lucid interval, followed by coma; (*c*) no lucid interval between concussion and compression symptoms.
2. General cerebral symptoms:	Complete loss of consciousness for some minutes to hours. Vomiting in milder cases.	Delirious unless complicated by concussion or compression. In acute spreading edema the delirium and restlessness follow as soon as concussion signs disappear or lessen.	Restlessness and apathy at first, gradually changing to deep coma in hemorrhage. Immediate compression signs in majority of depressed fractures.
3. Focal symptoms:	None unless complicated by contusion or compression or injury to cranial nerves in fractures of base.	Localized or general twitchings and convulsions, accompanied by pareses or paralyses. May have aphasia if third left frontal convolution is involved.	Localized (face or arm or leg) twitchings and convulsions precede paralysis (usually in form of mono- or hemiplegia). Convulsions less frequent in hemorrhage than in contusion.
4. Pulse:	Varies — either increased and irregular, or slow and full.	No change unless medulla is affected, then indistinguishable from paralytic stage of concussion and compression except by earlier onset of rapid feeble pulse.	Slow (40–60) and of high tension at first: later becomes rapid and irregular as soon as medulla is involved.

	Concussion.	*Laceration (Contusion).*	*Compression.*
5. Respiration:	Slow, shallow, and sighing.	Same as above; true for respiration.	Slower and labored (stertorous). May be irregular or of Cheyne-Stokes type in later stages.
6. Blood-pressure:	Slight rise.	No change.	Gradual rise as intracranial tension increases.
7. Pupils and eyeballs:	Equal and contracted in mild cases. Dilated in severe cases.	No change unless occipital lobe is involved (homonymous hemianopsia).	Pupils usually unequal and react differently to light. Dilated on side of injury.
8. Temperature:	Subnormal.	Quite high early and of continuous type. One of most important evidences of contusion.	Usually rises as pressure increases, but not as high as in contusion.
9. Lumbar puncture:	Negative.	Blood in spinal fluid under tension.	Blood only if intermeningeal hemorrhage, *i. e.*, into subdural space.
10. Course:	(*a*) Symptoms gradually decrease (stage of reaction) and recovery, or (*b*) signs of cerebral irritation appear (due to cerebral contusion).	Signs of localized injury gradually disappear. Very few become permanent.	Coma, etc., increase and paralytic stage sets in unless relieved.

Let us see under which of the divisions these patients belong.

CASE I

Examination of this patient upon admission to the hospital four days ago showed a man in coma with a long scalp wound over the right parietal region and extensive hemorrhage beneath the pericranium, but no visible fracture of the skull. Pulse was 94, full and bounding; the temperature was normal and the respirations 30 and shallow. There was involuntary urination and defecation. The pupils were unequal, but reacted to light. Lateral nystagmus was quite marked. Both eyelids were swollen, but there was no bleeding from nose or ears, nor were there occipital ecchymoses. The blood-pressure was 150 mm. A lumbar puncture allowed the escape of bloody fluid under tension. At our examination today the man is conscious and intelligently responds to questions, but rather slowly. The pulse-rate is 60 and the temperature is normal. He has regained control of the sphincters, but is still very restless, constantly pulling at his bedclothing and throwing himself about. There are no focal symptoms of a cortical lesion. A stereoscopic radiograph has not disclosed a fracture.

Glancing at our table, we find that this man's initial symptoms were those of concussion. The presence of a bloody fluid under tension obtained by lumbar puncture shows that there was intermeningeal hemorrhage or cerebral contusion present in addition to the concussion. The signs of concussion are now being replaced by those of cerebral edema or irritation, as suggested principally by the patient's restlessness. The absence of delirium, the normal temperature, and the absence of signs of localized injury indicate that the degree of contusion, the presence of which is strongly suggested by the bloody cerebrospinal fluid and the restlessness, is slight. There is no evidence of compression. We, therefore, make the diagnosis of moderately severe cerebral concussion with evidences of mild contusion.

This patient has been treated by the sovereign remedy in all cases of brain injury, unless signs of compression appear, that is, absolute rest. If necessary, morphin and bromids may be used freely in order to gain this end. No matter how mild a case of concussion may appear to be, it should be carefully watched for signs of incipient compression due to rupture of the middle meningeal artery with extradural hemorrhage or to a subdural clot from a wound of the venous sinuses or extensive injury of the vessels of the pia-arachnoid. The symptoms of compression due to subdural hemorrhage appear after a longer free interval, are much slower in developing, and not as well localized as those due to an extradural clot. It is well to remember, however, that if the dura is torn, hemorrhage from the middle meningeal may be both outside of and beneath the dura. I am not in favor of subtemporal decompression for cases of severe concussion or even of cerebral contusion, but believe that repeated lumbar punctures are equally as safe and afford more relief. One must remember that hemorrhage from the middle meningeal artery may appear several weeks after a head injury, and hence a severe case of cerebral concussion should be kept in bed and under observation for at least four weeks.

I believe that the position taken by Frazier[1] in regard to the indications for decompression in these head injuries is a most rational one. He divides the cases of concussion with associated contusion (rapidly increasing intracranial tension and rapidly diffusing edema) into: (1) Injury slight. Best to leave alone. (2) Damage great as shown by rising temperature—these die in a short time. (3) Serious cases, but life not threatened (slow full pulse, coma, and irregular breathing, *i. e.*, signs of medullary pressure); the maximum intensity of the clinical picture is reached in twenty-four to forty-eight hours, then there is gradual restoration of consciousness and subsidence of signs of pressure. (4) After first shock, symptoms of intracranial tension increase and signs of incipient respiratory and cardiac break-down appear. Groups 1 and 2 require no treatment. There is no benefit from decompression in Group 3 and it is only imperative in Group 4. You can readily distinguish cases of cerebral contusion from those of increased intracranial tension due to an extradural or subdural clot by the absence of focal signs of irritation and paralysis. A rise of temperature is pathognomonic of cerebral contusion and appears early. Fever appearing forty-eight to seventy-two hours after a head injury is usually due to infection or to some intracranial cause and not to contusion.

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[1] Progressive Medicine, March, 1916.

CASE II

This patient, a man of sixty, was brought to the hospital in a deeply comatose condition September 27, 1916. There were no scalp wounds or evidences of fracture of the vertex or base. Lumbar puncture showed a bloody fluid escaping under tension. No history as to the mode of injury could be obtained. There was no rise in temperature and the pulse, respiration, and blood-pressure did not indicate any increased intracranial tension. The case was diagnosed as one of severe concussion and moderately severe contusion. There was a gradual return of consciousness within three days after admission.

Convulsions or twitchings were not observed during these first three days, but after the symptoms of concussion had receded the value of our obtaining a bloody fluid under tension by lumbar puncture as an aid in the diagnosis of contusion and of intermeningeal hemorrhage was shown by the fact that the patient could not move the right arm and leg and could not speak. The radiograph of the skull was negative. We find today that when we show him a watch set at 3 o'clock and ask him whether it is 4 o'clock he indicates a negative answer by shaking his head, but he cannot speak. This shows that he has a motor aphasia, but no sensory aphasia. He seems quite intelligent and readily protrudes his tongue or lifts his left arm or leg. When the clouds of cerebral concussion disappeared from his mental sky and only the focal signs due to the cerebral contusion were left as evidences of his brain injury, the motor aphasia and spastic paralysis of the right arm and leg became noticeable. We have in this patient an example of how guarded our prognosis should be in every case of severe concussion or contusion of the brain. The damage to important cortical centers was completely obscured by the symptoms of concussion, and it was only when the angry waves (to use a simile) due to the oscillation of the tissues of the brain subsided that the extent of the wreckage in the shape of temporary destruction of the speech, arm, and leg centers could be seen. I say "temporary," because in the majority of cases the contused cerebral tissue is gradually replaced and the evidences of focal lesions like those in our patient slowly subside.

In every case of unconsciousness without a history one must differentiate coma due to brain injury from the following: Coma due to cerebral hemorrhage or to pachymeningitis hæmorrhagica (the latter a very frequent condition in alcoholics), uremic coma, diabetic coma, alcoholic coma, opium-poisoning, hysteric coma, and syphilitic or other forms of meningitis of non-traumatic origin. If one has excluded all of the above causes of coma, it is safe to say that the case is one of concussion due to injury, and the pulse, temperature, respiration, and blood-pressure must be noted at frequent intervals in order to make a diagnosis of cerebral compression due to hemorrhage should it appear, at the earliest possible moment. In many cases the symptoms of concussion may clear up and a lucid interval of hours to days intervene before the signs of compression appear. In other cases the free or lucid interval is so short as to be overlooked or entirely lacking. It is in this latter class that we so often miss the golden moment when surgical intervention would be of avail. The average duration of life in non-operated cases of middle meningeal hemorrhage is twenty-five hours. It follows that *eternal vigilance must be our watchword in head injuries.*

In this patient with evidences of such severe injury to the brain tissue in the left precentral and third frontal convolutions we must be very guarded in our prognosis. Restoration to function will be very slow and months of careful after-treatment will be required. The possibility of an abscess of the brain months to years later must not be forgotten. I have seen a case of cerebral abscess twelve years after a compound fracture of the frontal bone with severe contusion of the frontal lobe.

Let me emphasize the value of lumbar puncture in the diagnosis of intracranial injury and again urge you to be very conservative in the treatment of these cases unless evidences of compression due to hemorrhage appear; then operation should be performed at as early a period as possible. I will discuss the special subject of gunshot injuries in a later lecture.

CARCINOMATOUS ULCER ON POSTERIOR WALL OF STOMACH WITH PERFORATION INTO LESSER PERITONEAL CAVITY; WITH A TALK ON THE REHFUSS FRACTIONAL ASPIRATION METHOD BY DR. WALTER W. HAMBURGER

Summary: Signs and symptoms of carcinoma of the stomach; advantages of Rehfuss fractional aspiration method of testing gastric secretions over Ewald method; necessity of taking röntgenograms in lateral as well as in anteroposterior position in gastric cases; when to operate; exploratory gastrotomy.

October 13, 1916.

I DESIRE to present to you a patient who comes to the hospital complaining of "stomach trouble." His principal symptoms are:

1. Pain in the umbilical region, constantly present but more severe at times. The pain bears no relation to the ingestion of food and is rather sharp in character.

2. Loss of appetite and weight and an increasing inability to do his ordinary work.

3. A feeling of oppression and, as he expresses it, of "gas on the stomach."

The family history is negative. He drinks moderately. Examination of the heart and lungs yields negative results. The blood examination shows 4,590,000 red corpuscles, 89 per cent. hemoglobin, and 18,900 white cells. His nutrition is poor, the subcuticular fat being greatly decreased. There are no visible evidences of jaundice in the sclera or on the roof of the mouth, two locations where one can see evidence of icterus long before it appears on the skin. The abdomen is soft, retracted, and there is no visible peristalsis or tumor, although even on light pressure there is distinct tenderness in the epigastric region. Analysis of the gastric contents after an Ewald test-meal shows an absence of free hydrochloric acid and a marked decrease in the total acidity. Examination of both the stomach contents and of the feces shows the presence of blood. The röntgenographic examination shows evidences of retention and a marked irregularity (filling defect) along the lesser curvature near the cardia (Fig. 65).

The Ewald test-meal is being supplanted by a newer method known as the Rehfuss fractional aspiration method. I shall ask my colleague, Dr. Walter W. Hamburger, to explain it.

Dr. Hamburger: A piece of No. 8 or 9 rubber tubing with a heavy metal tip, having a number of slit-like openings, is swallowed by the patient. This tube remains in the stomach for three hours, during which time the contents are aspirated every thirty minutes. Rehfuss described the method in 1912, though the idea of passing a small tube and allowing it to remain in the stomach was suggested by Schule in 1895. The disadvantage of the ordinary Ewald meal is that you obtain only one reading after the test, the aspiration showing the condition of the gastric con-

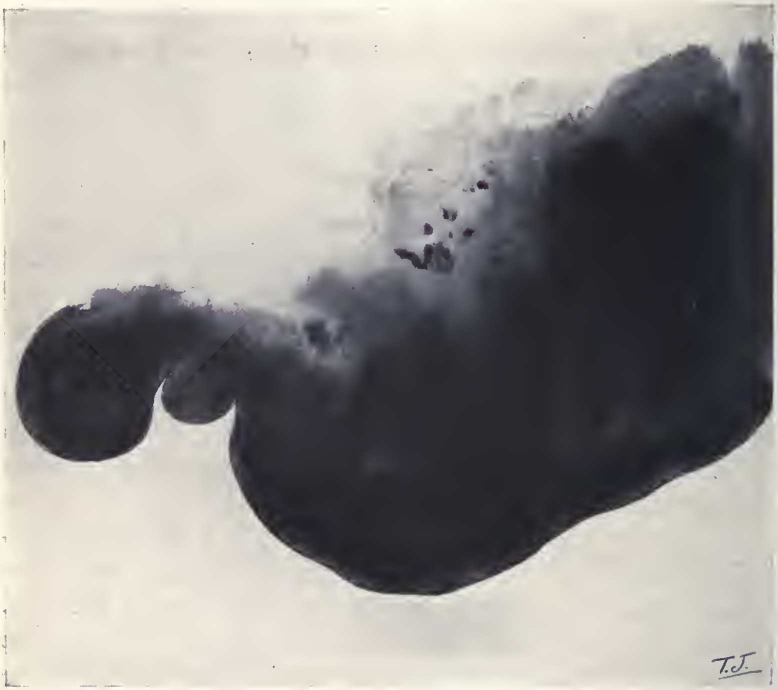

Fig. 65.—Filling defect on lesser curvature in a case of perforation of a carcinomatous ulcer of the posterior wall of the stomach.

tents forty-five or sixty minutes after the meal. It may be quite unreliable if the stomach functions are slow or variable. Rehfuss evolved a plan of frequent aspirations starting thirty minutes after a meal was given and continuing to aspirate at intervals of half an hour for three hours, thus getting an accurate picture of the whole cycle of gastric digestion.

We give 300 c.c. of tea containing lactose, and thirty minutes later the Rehfuss tube is passed and the first aspiration obtained. Then the other aspirations are made at intervals of half an hour for three hours. A glance at the results obtained (Fig. 66) enables one to make a definite curve showing both the secretory and motor functions of the stomach.

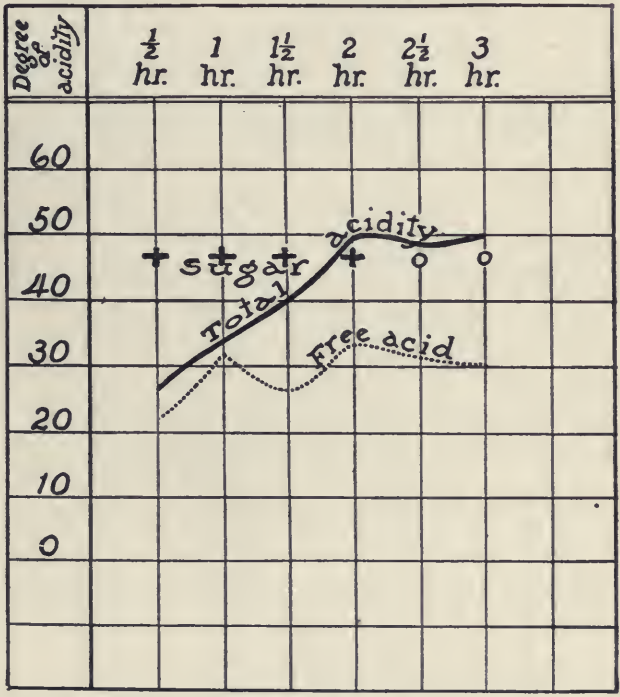

Fig. 66.—Curve obtained by Rehfuss test in a case of carcinoma of stomach with hyperacidity (Dr. J. C. Friedman).

In gastric carcinoma there is usually a diminution of both the free and total acidity, but there are many cases of benign diseases, such as achylia gastrica, in which the differentiation is very difficult because there is likewise a marked decrease in both free and combined acidity. Moreover, there is a group of achylias where the clinical picture resembles very closely a carcinoma of the stomach. Rovsing has described cases of severe gastroptosis associated with an achylia which simulated carcinoma very closely. In such cases the Rehfuss test is very valuable because it permits one to make a curve showing the progress of secretion at intervals of fifteen to thirty minutes for two to three hours. During the past year (1916) two comprehensive studies of the fractional method have been published by Talbot[1] and Fishbaugh.[2] The conclusions of the latter, as given below, are of great interest:

1. One-hour stomach examinations afford insufficient and often misleading information concerning the acidity and enzyme secretion. It gives no evidence of the secretory curve.

2. The fractional method of stomach examination follows the entire cycle of digestion, and supplies reliable information concerning the type of secretory curve, the degree of acidity, the ferment content, and an accurate estimation of the emptying time.

As the Rehfuss test was not used in the present case, it is, of course, impossible to tell you what the results of such an analysis would be, but I feel that it would follow closely that obtained by Dr. Friedman in a patient with a strikingly similar history and almost identical physical findings. As you see (Fig. 67), in contrast to the patient whose curve is shown in Fig. 66, there is a total absence of free acid throughout the test and the total acidity remains at a nearly constant and very low figure. Such a curve, representing several hours of observation, leaves little room to doubt that we are dealing with an actual anacidity; a complete loss of function by the acid-secreting cells.

DR. EISENDRATH: I am sure we are very much indebted to Dr. Hamburger for his very interesting presentation of this subject.

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[1] Jour. Amer. Med. Assoc., vol. lxvi., 1849, June 10, 1916.

[2] Jour. Amer. Med. Assoc., vol. lxvii., 1275, October 28, 1916. These articles review the literature and can be recommended to those who desire more detailed information in regard to the Rehfuss test.

Now to sum up, we have a history of a disturbance of gastric function in a man of sixty-six with marked loss of weight and strength. These three symptoms—(*a*) history of "stomach trouble," (*b*) loss of weight, and (*c*) loss of strength—should always lead us to examine a man of his age for signs of malignancy. Have we such signs? The absence of free hydrochloric acid and a marked decrease in combined acid is often found in carcinoma of the stomach and, although not pathognomonic of that disease, is very suggestive. Second, the large filling defect in the röntgenogram of the stomach, taken with the patient lying on his back, is indicative of a lesion in the stomach wall. Let me direct your attention to an omission in the method of *x*-ray examination of this case, namely, there is no report of whether the fluoroscopic examination, and the plates taken following it, included a view of

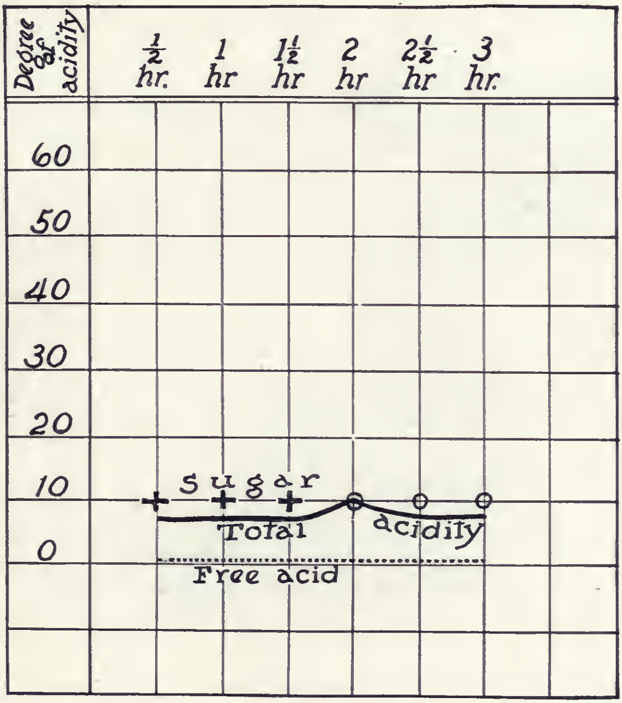

Fig. 67.—Curve obtained by Rehfuss test in a case of carcinoma of stomach with an acidity and impaired motility (Dr. J. C. Friedman).

the stomach in the lateral position so as to secure a view which would show an ulcer causing a bismuth or barium shadow in the posterior wall bulging into the lesser peritoneal cavity, if it were present. Such a lesion is illustrated by Fig. 68, taken from another case.

Third, the presence of blood in the stomach contents and in the stool is confirmatory of the x-ray findings, telling us that the defect is in the stomach and not on the duodenal side of the pyloric ring, and, in addition, that it presents a raw, bleeding surface.

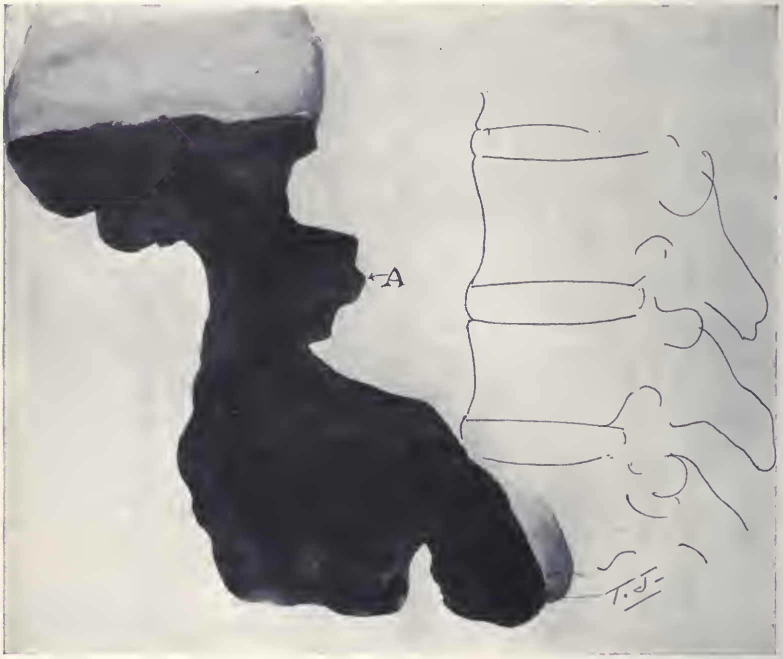

Fig. 68.—Redrawn röntogram (lateral view) showing diverticulum at A, which proved to be a perforated ulcer of the posterior wall of the stomach.

These considerations in conjunction with the age of the patient and the three points in his history which were mentioned earlier suggest to us the pre-operative diagnosis of carcinoma on the lesser curvature of the stomach. We might add, developing upon a chronic callous ulcer, in order to emphasize the probable close relationship etiologically between carcinoma and ulcer, but our failure to obtain a history of recurrent attacks of stomach trouble extending over a period of years hardly warrants the assumption.

Are we justified in performing an exploratory operation? Is our interference too late to be of much value? The ideal period for operative interference is not when a tumor can be felt, but rather when, with a suspicious history, we have *x*-ray evidences of tumor or of a calloused gastric ulcer. Some pathologists believe that 70 per cent. of such ulcers are already malignant, while others think that malignant changes are not found in more than 20 per cent. An explanatory operation is becoming more and more justifiable as the knowledge becomes more widely disseminated that the majority of chronic gastric ulcers are potential carcinomas. This being the case, we may feel not only that an exploratory operation is justified, but that it is demanded in this instance. How about the failure to palpate a mass in this man's abdomen? Never wait until a tumor can be felt. A cancer of the stomach which can be felt through the abdominal wall is usually past cure. In these cases it is better to operate on a justifiable suspicion than to await certainty. But we should operate even in the presence of a mass, first, because occasionally it may be susceptible of complete removal and, therefore, cure; and, second, occasionally such masses are only inflammatory and subside following the drainage afforded by the gastro-enterostomy. Therefore we will operate upon this man, being ready to follow the indications which our exploration may uncover.

OPERATION

A median laparotomy incision reveals the absence of liver or peritoneal metastases. One must never overlook the fact that metastases of carcinoma of the stomach may appear in the rectovesical or rectovaginal fold at a comparatively early period and can often be felt through the rectum before operation. One should examine the stomach in a certain order—*e. g.*, pyloric region, anterior wall, greater curvature, lesser curvature, posterior wall, and, finally, the cardiac end of the stomach. We find no changes in this stomach until we reach the lesser curvature, which appears irregular in outline, retracted, and fixed posteriorly by a hard mass which extends from the cardia almost to the pylorus. The mass involves the fat of the lesser omentum and the entire posterior wall of the stomach and the pancreas lying behind it. It feels more like an inflammatory induration, and the marked tenderness over the epigastrium and the leukocytosis (18,900) would seem to confirm this view were it not for the fact that a number of very hard lymph-nodes can be felt around the celiac axis (over the anterior surface of the spine). We know that quite a large proportion (52 per cent.) of such enlarged nodes are of inflammatory nature, but these are much too hard for such a possibility, and are undoubtedly of malignant nature.

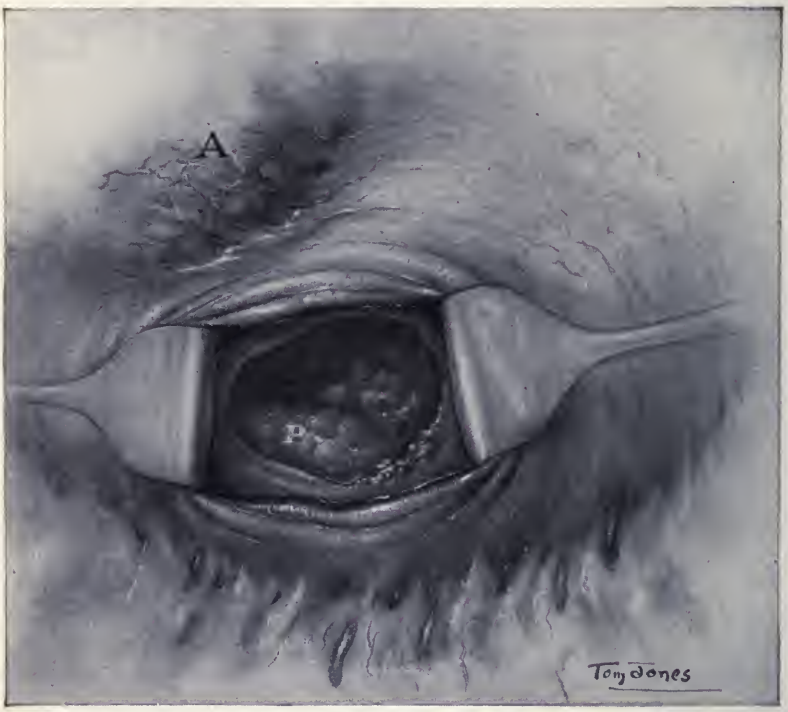

Fig. 69.—View through incision in anterior wall of stomach showing a large perforated ulcer of posterior wall with retroperitoneal tissues and pancreas forming floor of cavity. The edges of the ulcer were smooth with the exception of the lower left quadrant, which showed typical carcinomatous change. *A*, Inflamed tissue of lesser omentum forming upper wall of retroperitoneal abscess cavity; *P*, pancreas.

Let us open the stomach by a vertical incision through the anterior wall, a method which I call exploratory gastrotomy, and have found of great value in determining by palpation within the stomach the presence of ulcer or carcinoma in doubtful cases. We now see that if we had made the fluoroscopic examination and taken the plates with the patient in the lateral position our diagnosis could have been made even more detailed than that of carcinoma of the lesser curvature. There is a defect in the posterior wall of the stomach about the size of the palm of the adult hand which represents an extensive perforation of a carcinomatous ulcer (Figs. 69 and 70) into the lesser peritoneal cavity. The edges of the defect are soft except along its lower border, where a typical carcinomatous edge presents.[1] The walls

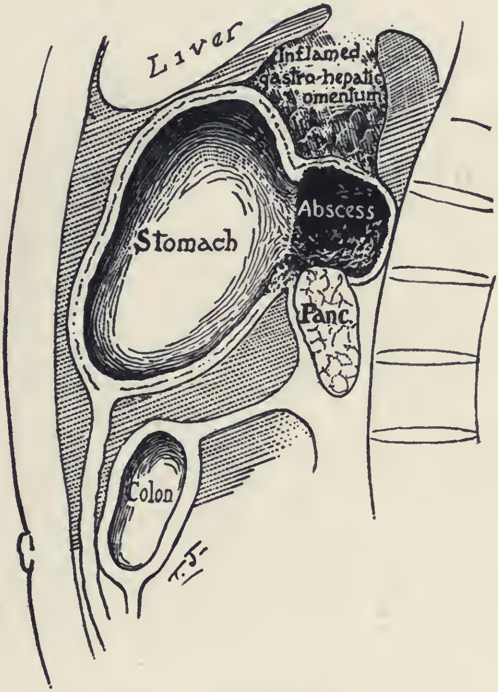

Fig. 70.—Diagrammatic sagittal section showing relations in case of perforating carcinomatous ulcer of posterior wall of stomach.

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[1] Microscopic examination confirmed the carcinomatous character of the edge.

of the cavity are formed by the retroperitoneal tissues, especially the pancreas, and the floor of the cavity is covered by the debris of decomposing food particles. Radical operation is out of the question, so our exploratory gastrotomy will be sutured and the abdomen closed in the usual manner.

This case illustrates the adaptability and the technic of the Rehfuss method, the necessity of lateral views when röntgenographing stomach lesions, and the relatively few signs that may follow perforation of the posterior wall of the stomach. I also believe that it lends weight to my admonition to operate such cases on justifiable suspicion and never to let the absence of palpable intra-abdominal tumors outweigh the evidence furnished by the history, the laboratory findings, and the *x*-ray.

CLINIC OF DR. KELLOGG SPEED

Cook County Hospital

TENDOPLASTY FOR WRIST-DROP; DESCRIPTION OF A NEW OPERATION

Summary: Indications for operation; technic; advantages over older methods; results.

This operation is intended to alleviate the deformity of wrist-drop in permanent lesions of the musculospiral nerve. An endeavor has been made to conform to anatomic and orthopedic principles in its technic and application. Besides the main indication under which this operation was devised, that is, severance of the nerve by gunshot injury, it can be used in any traumatic injury of the nerve in which it is proved that there is complete loss of neuron conduction requiring correction by suture, nerve plastic, or other operation. If the nerve destruction is irremediable, the operation offers a permanent cure of the deformity, not a complete restoration of function. If the nerve injury is amenable to treatment, but many months of waiting for neuron growth is expected, the tendoplasty promises to retain a balance in the forearm muscle groups and prevent some atrophy and contraction in the flexors, as well as stretching of the extensors pending the time of renewed active function of the muscles.

TECHNIC

The accompanying illustrations demonstrate the procedure. Longitudinal incisions are made over the flexor carpi radialis and ulnaris tendon to expose them (Fig. 71). One-half of each tendon is cut from its wrist insertion, a longitudinal split is made up toward the muscle belly, giving a sufficient length of free tendon to pass across the back of the wrist by a tunnel through the superficial tissue (Fig. 71). The dorsum of the hand is opened by a small incision over the heads of the second and fifth metacarpal bones, the periosteum is incised and reflected, and the free ends of the cut tendons are sutured to bare bone by a cutting needle with silk or kangaroo tendon while the hand is held in *complete*

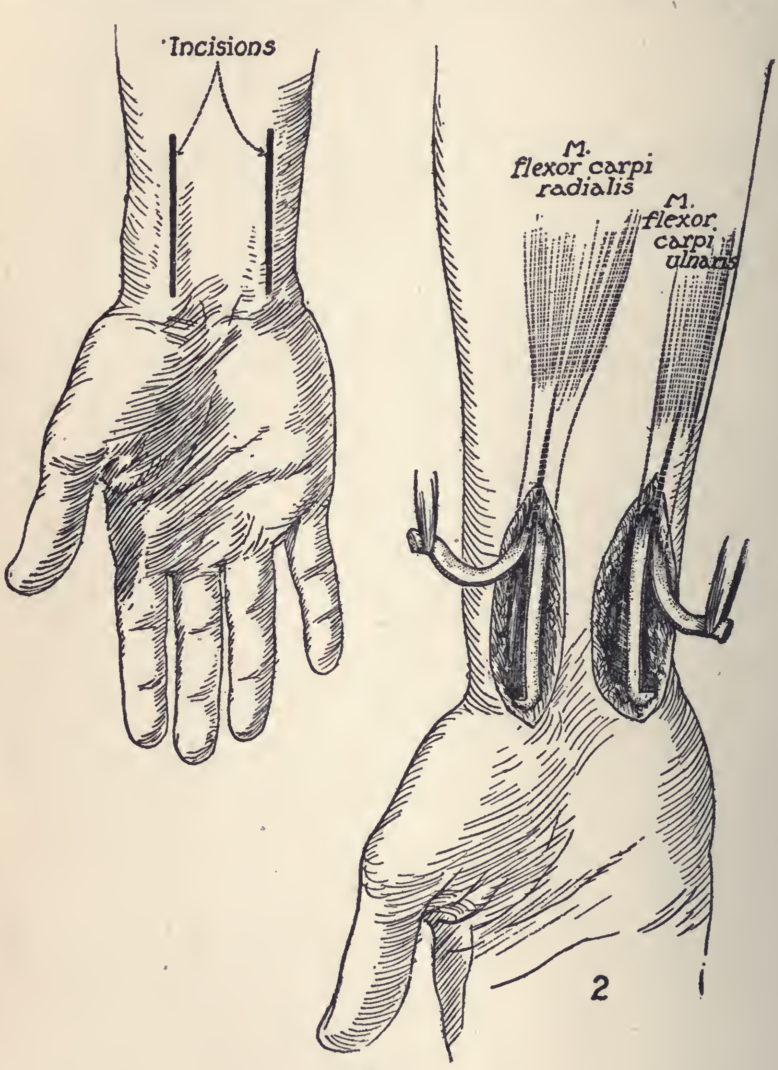

Fig. 71.

extension (Fig. 72, 4). A Jones metal extension hand splint is applied to hold the hand rigidly in hyperextension (Fig. 72, 5).

The insertion of the tendons into the bone gives a safe ortho-

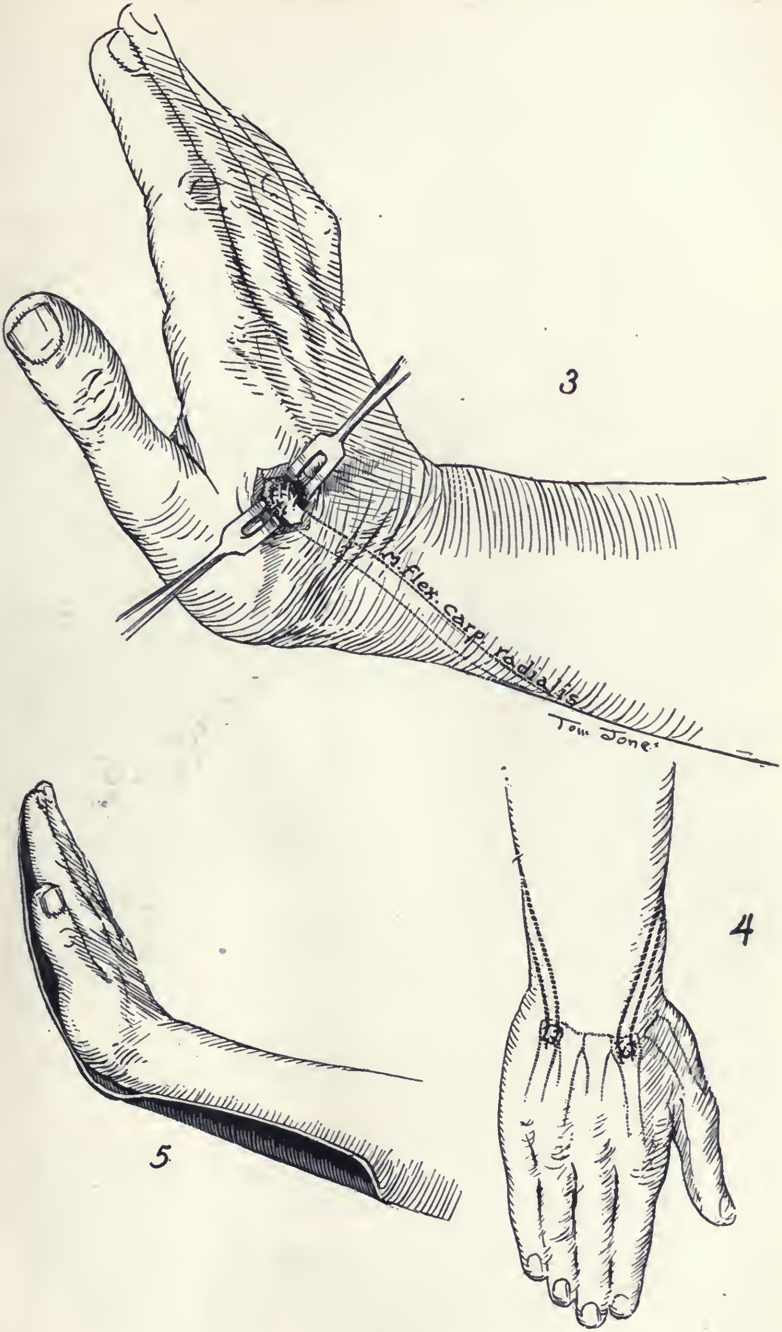

Fig. 72.

pedic anchorage. An anchorage into the extensor tendons is tedious, exposes larger areas to infection, and is uncertain in result. The use of one-half of each flexor tendon gives greater strength, *balances the hand* in extension or flexion, and leaves one-half of the tendon for its normal function. The use of all of either flexor tendon leads to a hand unbalanced toward the ulnar or radial side.

Hyperextension is maintained at least three weeks. After five weeks the hand assumes a position of balance and slight extensor power is possible. Grasp and flexion are uninterfered with. In one case (Fig. 73) so operated on, in spite of an infected wound in the arm, a perfectly aseptic result was obtained and the patient had 10 to 12 degrees extensor power at the wrist in five weeks. A nerve suture had been performed three days before this picture was taken, with the excision of $\frac{3}{4}$ inch of the nerve trunk in the arm, so that all motion depended on the new tendon insertion.

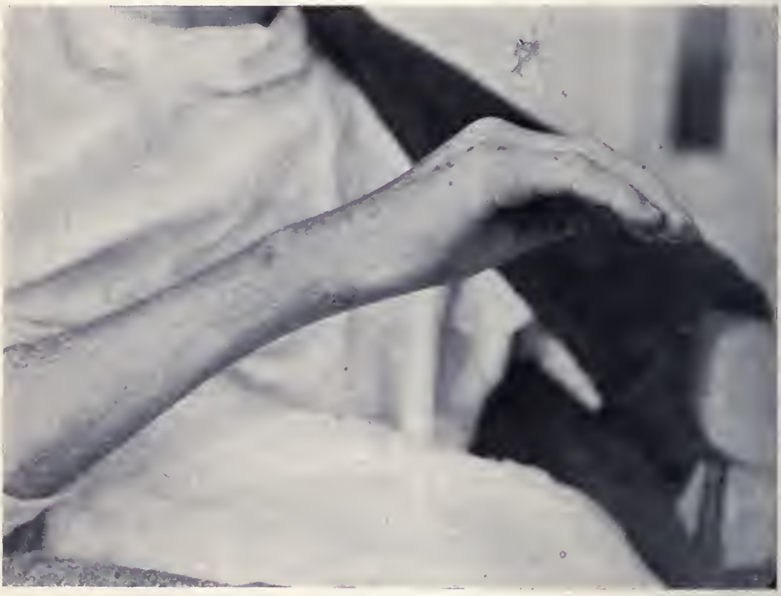

Fig. 73.—Case on whom tendon operation was performed for wrist-drop. The picture was taken one week after musculospiral nerve was resected ($\frac{3}{4}$ inch removed) and sutured. Note that he can and does hold hand in balance. He had 10 to 15 degrees of extension in the hand above the straight line.

CLINIC OF DR. SAMUEL C. PLUMMER

St. Luke's Hospital

A CASE OF CALCULOUS ANURIA

Summary: A patient who has had repeated attacks of bilateral lumbar pain associated with the passage of gravel and blood, and several periods of complete anuria which were successfully treated by non-surgical measures; questions in diagnosis; pyelotomy with removal of uric acid calculi which were not disclosed by the pre-operative x-ray examination; recovery.

October 3, 1916.

The patient, J. D., you will notice is a man of large frame. He is fifty-eight years of age, white, and a painter by occupation. As to his personal habits, he smokes to excess and uses alcohol somewhat beyond the limits of moderation. You see that he is well nourished and has thick abdominal walls.

The patient states that about five years ago he had his first attack. It began by dull constant pain in the left lumbar region, which lasted two or three hours. After the pain subsided he noticed small gravel in his urine. Six or eight months later he was taken with a similar attack which was somewhat more severe than the first. Other attacks followed at shorter intervals and were a little more severe each time. Three years ago he had quite a severe attack, which was followed by blood in the urine and passage of several quite large stones and blood-clots. The attacks became still more frequent and the pain became quite sharp at the height of each attack, with a duration of eight to ten hours. During this time neither change of position, hot applications, nor anything else gave relief. Each was followed by the passage of a considerable number of stones. During the later attacks the pain was equal on both sides.

In May, 1916, he had a very severe attack similar to the above, which was followed by complete suppression of urine for forty-eight hours. He was taken to a hospital and treated by sweats and bleeding. He had pronounced symptoms of uremia during this attack, reaching even the stage of coma.

In September, 1916, he had another attack which resulted in anuria, which began on September 4th. I saw him first at his residence on September 7th with Dr. Neil M. Gunn. At this time his general condition was good, but in view of the history of the previous attacks, in which pronounced uremic symptoms developed, it was thought advisable to send him to St. Luke's Hospital.

On September 8th a cystoscopic examination was made by Dr. Arthur H. Curtis. The findings were as follows:

There was a slight erosion of the fundus and a moderate general congestion of the bladder. There was no urine in the bladder and the ureteral orifices were normal. Both ureters were catheterized to the kidneys and no urine obtained. The patient was given diuretin, and on the evening of September 8th was given $\frac{1}{60}$ grain of pilocarpin hypodermically while in a hot-pack, during which diaphoresis was profuse. This was followed by an ampule of pituitrin, and within a few hours he passed 6 ounces of urine after almost five days of complete anuria. About thirty-six hours before he began to urinate the patient developed uremic symptoms and became quite irrational. After he once began to pass urine the flow continued to be free. The patient left the hospital on September 13th against my advice. His general condition was satisfactory, but I wished to make further examinations of him to determine if possible the cause of his anuria.

Six days later the patient entered the hospital a second time, giving a history of complete anuria of two days' standing. He was treated as before, but it was not until September 23d that he again urinated, after having again developed uremic symptoms. Thus he had had another period of six days with complete anuria. As in the instance of his first stay in the hospital, the urination continued quite free after once being established. An *x*-ray examination failed to show any stones, but showed what we took to be the outline of a kidney about four times the normal size. Up to this time it was impossible to tell which kidney was affected. It is true that during his first attack the pain was located on the left side, but later it was equally severe on both sides. Repeated urinalyses failed to show the presence of casts, although there was always a small amount of albumin present with a greater or less number of white and red blood-cells. On September 29th the second cystoscopic examination was made. Both ureters were again catheterized and after an interval of ten minutes there was no flow of urine from the left kidney, although the right kidney secreted freely. We were now one step further along in the diagnosis, as we knew that the right kidney was the one that was functionating. We now have the question of diagnosis to decide as nearly as possible. The history of the case would lead one to suspect renal calculus on account of the fact that he had several times passed small stones. The fact, however, that the *x*-ray failed to show a stone casts some doubt upon this diagnosis. The cystoscopic examination has shown us that there is no stone in the ureter. Lead-poisoning was considered owing to the man's occupation, but he shows none of the characteristic signs of this trouble. Nephritis seems to be ruled out by the repeated failure to find casts in the urine. The question of a tumor, most likely a hypernephroma, deserves consideration, owing to the fact that the *x*-ray apparently shows a greatly enlarged kidney on the left side. We are not able at this time to make a positive diagnosis, but we feel sure that the trouble, whatever it is, is located in the left kidney. Consequently, the operation which we are about to perform is exploratory.

OPERATION

The incision is made in the usual way, the patient lying on his side and having the portion of the table opposite the lumbar region elevated to push the kidney upward. Great care is taken to see that the patient does not lie upon his arm. I once had the unfortunate experience of having a patient get a musculospiral paralysis from neglect of this precaution during this operation. The incision is made obliquely parallel to and a little below the twelfth rib. When we come down upon the fatty capsule we find that it is not normal, but is infiltrated and in places quite decidedly indurated, so that in most locations it is torn apart with difficulty. The fatty capsule is adherent to the kidney, and only in a few places can it be separated cleanly from the kidney, and in the greater part of the kidney surface portions of the fatty capsule have to be left adherent to the kidney. This is contrary to the usual experience in dealing with a normal fatty capsule, in which case the kidney is easily shelled out of its capsule. The kidney is about half again the average normal size, and upon palpating the pelvis I find a large stone. I now make an incision into the pelvis of the kidney and extract this large stone. You will notice that it is of very light weight for its size. Upon exploring the calices with my finger I find a number of small fragments of stones, and these are removed with forceps. I now place a drainage-tube in the pelvis of the kidney and close the wound.

The question is, Why was not this stone detected by the *x*-ray? This question takes on an additional interest when I inform you that another patient in this hospital on the service of Dr. Halstead had an *x*-ray examination by the same radiographer, using the same apparatus, at almost the same time as my patient. Although this patient had even heavier abdominal walls than our patient here, a stone was plainly shown. The stone in this case was much heavier in proportion to its size than the stone we have here. It is probable that the chemical composition of the two stones is different.

The findings in the kidney are of interest in view of the fact that the pelvis was not dilated and contained no urine. There was absolutely no evidence of any urine being present when the pelvis of the kidney was opened. In view of the fact that the cystoscopic examination showed no obstruction of the ureter and the operation showed no sign of any obstruction to the outflow of urine from the pelvis of the kidney, this case of calculous anuria is not due to any obstruction, but simply to the presence of the stone. Another question arises as to why the *x*-ray apparently showed a kidney at least four times the normal size, whereas the operation revealed the kidney only about one and one-half times the normal size. It seems possible to me that the infiltrated and indurated condition of the fatty capsule might account for this enlarged shadow.

Postscript.—The stone measures 3.8 x 4.0 x 2 cm. in its longest diameters, tapering off toward the extremities, and weighs only 12.2 gm. The chemical examination shows it to be pure uric acid, tests for calcium salts and phosphates being negative. The chemical composition accounts for the light weight of the stone in proportion to the size, also for the difficulty of getting a shadow with the *x*-ray.

As to the after course: The patient passed 1 ounce of urine at 10 o'clock the day of the operation. The next day he passed 2 ounces at 7 A. M. and 3 ounces at 3 P. M., and larger amounts later, the total for the day being 14 ounces. The second day he passed 33 ounces and the third day 43 ounces, and from that time on the daily amount was normal. It is interesting to note that no urine ever came from the wound, showing that the kidney had not begun to functionate until after the wound was healed. The drainage-tube was removed five days after the operation. The wound healed throughout by first intention.

CLINIC OF DR. EDWIN W. RYERSON

Chicago Policlinic Hospital

ANKYLOSIS OF ELBOW

Summary: Fixation of right elbow-joint due to arthritis deformans; technic of exposure of joint by long posterior incision; shaping the new joint; transplanting of free fascial flap—closure and after-treatment; prognosis; comparative results of arthroplasties on elbow, hip, and knee.

October 6, 1916.

This operation is an arthroplasty, or an operation to restore motion to a stiffened joint. The patient is a woman of fifty, whose right elbow is flexed at a right angle and has a range of motion of only 4 or 5 degrees. The condition is due to an osteoarthritis, or arthritis deformans, which never produces complete bony ankylosis, but which in this case has enormously impaired the motion of the joint.

Instead of the usual lateral incisions at either side of the elbow, I make a very long posterior incision, just avoiding the olecranon, and carefully dissect up the skin and fat on both sides, retracting the flaps widely so as to expose the entire back of the elbow region. The incision is 6 or 7 inches long, with its center at the olecranon.

The problem is now to expose the entire joint without doing any harm. I could saw through the olecranon, but it would not be as satisfactory as the method which I will show you. Starting at the upper end of the olecranon, I split the triceps tendon with a knife, cutting upward a distance of about 2 inches. This divides the tendon into two parts. The inner portion is now cut across where it joins the olecranon, and the outer portion is cut across at the top of the incision, 2 inches above, sparing as many of the muscle-fibers as possible. You will see, after the rest of the operation is finished, that it will be easy to sew together these

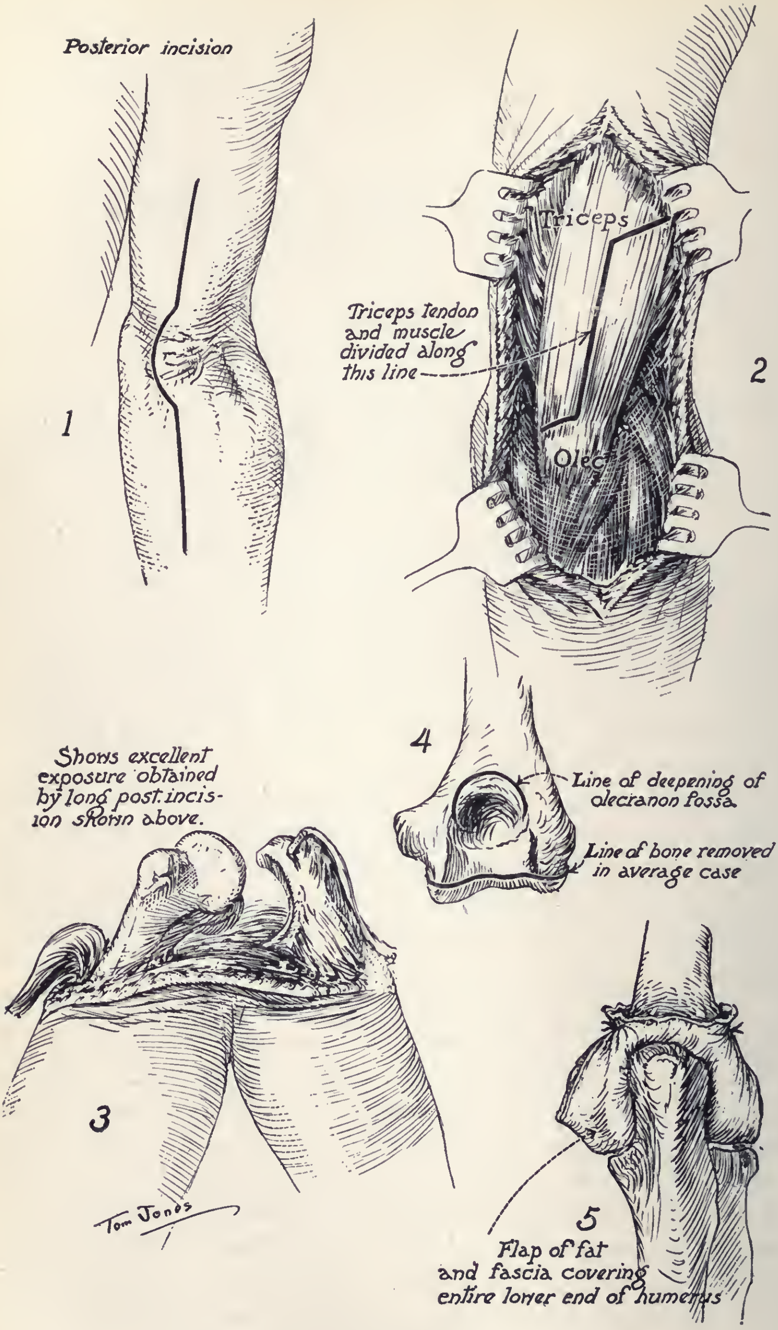
Posterior incision
1
Triceps
Triceps tendon and muscle divided along this line
2
Olec
4
Line of deepening of olecranon fossa
Line of bone removed in average case
Shows excellent exposure obtained by long post. incision shown above.
3
Tom Jones
5
Flap of fat and fascia covering entire lower end of humerus

Fig: 74.—Operation for ankylosis of the elbow.

two halves of the triceps with a number of interrupted sutures and to obtain a large area of contact and a very strong union. Now, in the space between the olecranon and the inner condyle I isolate the ulnar nerve and retract it out of the way. The condyles must now be exposed. The extensor muscles arise from the outer condyle, and the flexors from the inner. I take a chisel and remove a thin shell of bone from the external condyle, carrying with it the origin of the muscles. This is also done on the inner condyle. I now cut into the joint, severing as much of the thickened capsule and intra-articular fibrous tissue as can be reached with the arm in this position. This is a very complete fibrous ankylosis with marked peri-articular changes and it is hard to find the joint lines. The arm can now be acutely flexed and the rest of the restraining tissues divided.

Now, you see, the forearm can be completely dislocated, and the end of the humerus is completely freed. I must now remove a section of the lower end of the humerus at least $\frac{1}{4}$ inch in thickness to give sufficient play to the joint. With this very sharp curved chisel, a carpenter's gouge, I take off the end of the humerus, using a gouge of the same curve and size as the articular surface of the bone. Now with the flat file we smooth off the bone as accurately as possible.

Since the joint has been moved upward $\frac{1}{4}$ inch, I must now make a new fossa for the reception of the coronoid process of the ulna, which I do with a small gouge. The olecranon fossa on the back of the humerus must be similarly enlarged upward. All of the small fragments of bone must be carefully removed, as they are potentially osteogenetic and may cause trouble. Now I test the motion in the joint and find that it flexes very well through the full range of motion from a right angle, but it does not extend well at all. This is due to the structural shortening of the biceps, and can probably be overcome by exercises. It does not seem wise to attempt a plastic lengthening of the biceps at this time.

I now have to make a flap of soft tissue to place between the bones to prevent ankylosis. There does not seem to be enough tissue in the neighborhood to make a satisfactory flap, so I will remove a piece of the fascia lata. This is done through an incision on the right thigh, and a piece of fat and fascia about 3 by 5 inches is quickly removed. These fascial flaps never seem nearly as large after they have been taken out. We do not need much fat on the flap, but only a thin layer.

Now I will lay this flap over the entire end of the humerus, and be sure that it is carried well up in front of the bone. The flap is now sewed securely all around the end of the bone except at the lateral ends of the condyles, where the flexor and extensor origins have to be re-attached. I think that a perfectly free flap of this kind actually gets as much nutrition as a flap with a narrow pedicle, since a pedicled flap must always be rotated or turned over to such an extent that its original blood-supply is probably cut off by constriction. At all events, the free flaps have given satisfactory results quite as often in my experience as the pedicled flaps.

The split and divided triceps is now sutured with eight or ten interrupted chromic catgut stitches, and you see what a large area of union this method affords. It will be quite safe to begin active and passive motion within two weeks, whereas one might have considerable hesitancy in doing this if the olecranon had been sawed and then wired or sutured.

The elbow-joint gives excellent results after arthroplasty in the majority of cases. The hip-joint gives the next best. The knee-joint, unfortunately, where we should like very much to get good results, is an extremely difficult proposition, although a few good cases are on record.

The question always arises whether or not the joint will later stiffen. The experiments of Allison and Brooks[1] tend to make one believe that sooner or later the ankylosis will recur, although their experiments were made on animals. Perhaps on the human the results will be different. It would, of course, seem undesirable to put more fibrous tissue in the shape of fascia into a joint which is already the seat of a bony or fibrous ankylosis, but we are certain that many joints which have been operated on in this way have remained movable for at least a year. We know that the hip-joint in several of our cases has remained movable for at least two years, though it will take several more years of observation before we can be absolutely certain about the results. The knee-joint is technically the most difficult because so much of the stability of the knee-joint depends upon the ligamentous structures. The elbow and the hip depend much more upon the bony architecture than upon the ligamentous tissues. We cannot artificially, at the present time, reproduce the crucial ligaments of the knee. Fortunately, the crucial ligaments are not quite as necessary for the lateral stability of the knee-joint as they are for the anteroposterior stability. We can reproduce fairly well the lateral ligaments of the knee-joint, and many good arthroplasties exist without any disabling lateral instability. I do not feel that the position of the knee arthroplasty is as yet fully established. Dr. Murphy, as you well know, was enthusiastic in the field of knee arthroplasty. He believed that it was possible uniformly to get good results, but most other operators have failed to do so. We have all had some good ones and we have all had some bad ones. It appears at the present time to many of us that, in a case where there is bony ankylosis between the femur, tibia, and patella, the chances of obtaining a good movable knee-joint are not very bright; that if bony ankylosis exists between two of the bones only, for instance, between the patella and the femur or else between the tibia and femur, we can hope for better results. The ankylosed hip and the ankylosed elbow can be operated on very confidently by the proper technic.

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[1] Allison and Brooks, Jour. Amer. Med. Assoc., 1915, lxiv, p. 391.

It is likely that we shall not have perfect motion in this arm for a long time, and it is barely possible that we shall not have perfect motion at any time, but the patient will be able to flex the elbow, which is of great importance. She will be able to sew and to do her hair, which has been impossible for two years.

This woman has had her tonsils removed and her teeth extracted, and for a time vaccines, made from the abscessed teeth, were injected subcutaneously. All the acute symptoms of arthritis deformans have disappeared and there remained previous to operation only the restriction of motion in the elbow-joint. We should not have attempted to mobilize this joint if the patient were still suffering from an active arthritis deformans.

There is now plenty of flexion in the elbow. I am not going to try to overcome the biceps contraction for the present. You see she has very good pronation and supination. This is the first exposure of the elbow-joint I have ever made by the long posterior incision, and I think it is a perfectly sound and good method. The reason I am putting this arm up in an internal angular splint is that I do not want any weight to be borne on the joint. The flap is poorly enough nourished, whether it is a free flap of fascia lata or a slightly pedicled flap, so to do a successful arthroplasty the operation should be followed by traction. In the arthroplasties on the hip we always use a heavy traction with a 16- to 25-pound weight and maintain that traction for four to six weeks, because we do not want any pressure on the flap. In this woman we will put on a splint and, if necessary, put a weight on the inner side of the splint on the forearm, so it will draw the joint surfaces farther apart. We can support the hand in a sling and she will get along very well.

CLINIC OF DR. D. B. PHEMISTER

PRESBYTERIAN HOSPITAL

ECHINOCOCCUS CYST OF THE LIVER COMPLICATED LATER BY SUBPHRENIC PYOPNEUMOTHORAX AND HYDROPNEUMOTHORAX

Summary: History and physical examination of patient; differential diagnosis of echinococcus cyst of liver from hemangioma, cystic lymphangioma, primary and secondary carcinoma, subphrenic and hepatic abscess, syphilis of liver, hydrops of gall-bladder; value of complement fixation test in diagnosis of echinococcus: operation—Sprengel incision—marsupialization of cavity; development of subphrenic pyopneumothorax four weeks after operation; diagnosis and treatment of this complication; development of hydropneumothorax following the subphrenic lesion—diagnosis and treatment.

October 19, 1916.

HERE is another equally rare and interesting case which was admitted to the hospital seven weeks ago. This woman is thirty-eight years old. She is a Greek and has been in the United States for six years. She has been married eleven years; has had two miscarriages, each at the third month, but no living children. She has always been well until four years ago, when the present trouble began.

While washing one day she was taken with pain in the right upper quadrant of the abdomen. The pain was so severe that she had to quit work. She had nausea and vomiting. The pain radiated to her back to some extent. It wore off gradually, lasting for two or three days. She soon had a recurrence and during the next two years had repeated attacks of pain in this region. On only one other occasion were they associated with nausea and vomiting. About a year after the onset of these attacks she noticed a swelling beneath the right costal margin low down. This swelling has persisted and gradually increased in size. During the past two years she has had more or less constant pain in the region of the liver. Her general health has been fairly good. She has never been jaundiced, even with the first attacks. She has lost 10 or 12 pounds in weight, though she is still well preserved. She has had no symptoms in any other part of the body. Her appetite has been good, bowels regular. There has been no diarrhea or constipation. On account of the pain she has been more or less incapacitated for work, though she has done her housework most of the time. The venereal history is negative.

On admission to the hospital examination showed a fairly well-nourished woman weighing about 150 pounds. Her skin was dark, but there was no evidence of jaundice. The results of the examination of the head, neck, and extremities were negative. On inspection of the abdomen I observed she had a tumor mass which could be seen in the right side beneath the costal margin, beginning at about the outer fold of the rectus muscle and extending downward and backward. It was an oval-shaped swelling. On palpation it was smooth, rounded, and regular in outline. It seemed to be attached to or continuous with the lower border of the liver. The sharp edge of the left lobe of the liver could be felt and followed over to the mass. The gallbladder could not be palpated. The mass moved with respiration. Examination of the rest of the abdomen was negative. No fluctuation, thrill, or fremitus could be felt on palpation of the mass. Examination of the chest was negative except the right thorax, where liver dulness extended much higher than normal. There was flatness at the fourth rib anteriorly, the sixth rib laterally, and the eighth rib posteriorly, and very slight respiratory mobility of the lower border of the lung, decreased breath sounds, and tactile and vocal fremitus over the dull area. Fluoroscopic examination of the chest and abdomen showed this dulness to be due to enlargement in the hepatic region which displaced the diaphragm upward and restricted its normal mobility. The palpable mass in the abdomen was continuous and movable with the lower border of the liver.

What lesions would you think of in explanation of these symptoms and findings? You would think of a liver tumor.

What tumor of the liver might produce this picture? Of the liver tumors, you would think of a hemangioma or a cystic lymphangioma. These conditions rarely produce swellings of this size. They are common autopsy findings, particularly hemangiomas, but are small lesions which make no symptoms. What else would you think of? A carcinoma of the liver. Primary carcinoma of the liver is extremely rare. Metastatic carcinoma, secondary especially to a primary cancer of the stomach or large bowel, is extremely common. But this patient presents none of the evidences of a malignancy and no signs of a tumor of the gastro-intestinal tract. Stomach and stool analysis and a complete barium ingestion and enema were negative. This tumor is smooth and large, while carcinoma metastases are very nodular. The blood showed 85 per cent. hemoglobin, 9000 leukocytes, and a practically normal differential count—22 per cent. small lymphocytes, 13 per cent. large lymphocytes, 3 per cent. large mononuclears, 2 per cent. eosinophils, 60 per cent. neutrophils—so her general condition and the blood findings would speak against a malignancy.

We might think of a subphrenic or a liver abscess, but she had no evidence of an infection, so that, with the history of four years' duration, is against a subphrenic or liver abscess. This mass was attached to the liver and did not go back to the kidney region. The urine examinations were negative, which would help to rule out a kidney lesion.

You have to think of an enlarged gall-bladder. This might have been a cholecystitis with stone in the cystic duct producing a hydrops of the gall-bladder, but the location of the mass ruled out gall-bladder trouble. It extended too far to the right and downward and was too definitely blended with the liver. A distended gall-bladder extends downward from the tip of the ninth costal cartilage beneath the rectus muscle and does not go to the right as with this tumor.

One of the first things I thought of was an extensive gummatous involvement of the liver. The left lobe of the liver is more often involved by palpable gumma than the right. Of course, the left lobe can be felt easier than the right. We are not apt to see large gummatous masses after four years of symptoms from a syphilitic involvement of the liver. We may see them, but what frequently happens before that time is this: First you get the gummatous tumor formations which are palpable, and then in six months to two years healing occurs with contraction, and instead of an enlargement you get a shrinkage of the liver. I have seen autopsies where the left lobe was practically obliterated by the healed lues. In this case two Wassermann tests were negative.

This leaves only echinococcus cyst for consideration. What is there about the patient to make you think of this possibility? Her nationality; echinococcus disease is common in all the eastern Mediterranean countries. Most of the cases we have had in the Presbyterian Hospital have been in Greeks. What about her home life? She has been in America six years and has had no dog here, but had a dog about the home in Greece, and we know that the dog is one of the hosts of the adult Tænia echinococcus. The long duration of the process and the excellent general condition of the patient speak strongly for echinococcus. Urticarial attacks which are common in the disease have been absent in her case. The percentage of eosinophils, which may be markedly increased in echinococcus disease, is normal. The complement-fixation test, using the patient's blood and the fluid from an echinococcus cyst operated on here one and one-half years ago and kept in sealed tubes, was strongly positive. This reaction, introduced by Weinberg, is as valuable in the diagnosis of echinococcus as is the Wassermann reaction in syphilis.

Six weeks ago the patient was operated on under this diagnosis. The abdomen was opened by the Sprengel transverse incision, beginning just above and outside of the umbilicus, and extending outward across the abdomen beneath the lateral costal margin (Fig. 75). The rectus was cut transversely, the external oblique detached from its costal attachment, and the internal oblique and transversalis muscles split in the direction of their fibers. On entering the peritoneal cavity the mass was found to be in the right lobe of the liver. It rounded off the liver edge and extended internally to the gall-bladder and posteriorly to the posterior portion of the liver. The space between liver and diaphragm was obliterated anteriorly by adhesions. The liver substance was markedly thinned out over the swelling and palpation revealed fluctuation. I aspirated and obtained a clear fluid. I opened this cystic cavity by a longitudinal incision along the margin of the liver about 3½ inches in length. The liver substance was so thinned that in most places it was only 5 to 8 mm. thick. In some places there was only a fibrous capsule forming the wall of the cyst. When I opened the cavity large numbers of the

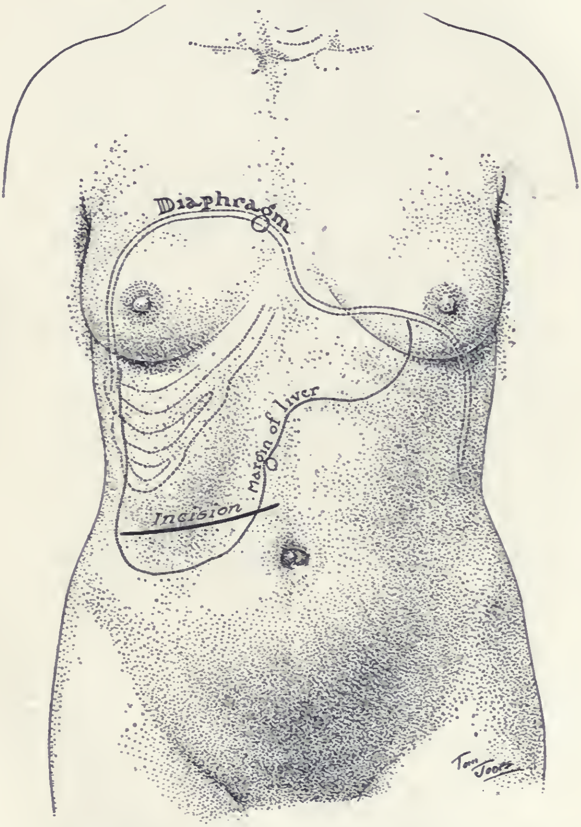

Fig. 75.—Diagram illustrating the great enlargement of the liver due to the cyst and especially its encroachment on the right pleural cavity. The line of the Sprengel incision is also indicated.

echinococcus cysts escaped. Here they are (showing specimen), and, as you see, vary in size from a pea to an egg. I used a gall-stone receptacle as a scoop for emptying the cavity. About 3 quarts of fluid and cysts were removed. After removing all that I could with this scoop, I introduced my hand up to about the middle of my forearm into the cavity which extended upward and

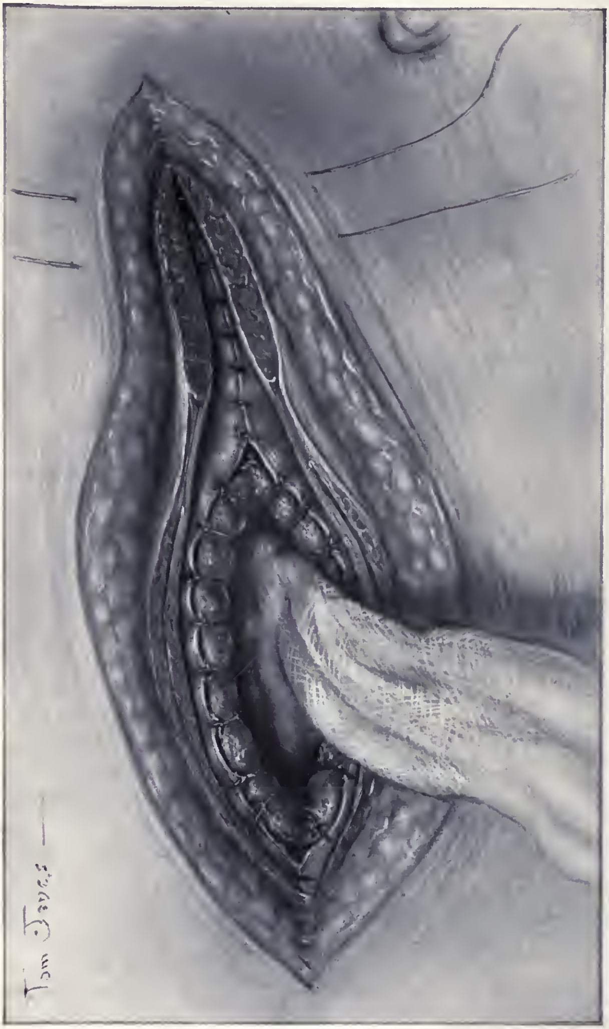

Fig. 76.—Marsupialization of the cyst. The edges of the incision in the cyst have been stitched to those of the peritoneal incision and the cyst cavity packed with gauze. Note the transverse section of the right rectus muscle which is permitted by this incision.

backward well toward the diaphragm. I succeeded with my fingers in breaking into some cavities that had not been opened, and more cysts escaped, which I removed with my hand. A bimanual palpation of the rest of the liver was made in search of other cysts, but none were found. The cavity remaining was lined by a thin irregular layer of fibrous tissue and only partially collapsed. A large strip of gauze was carried to its bottom and marsupialization performed by suturing the edges of the opening to the peritoneum external to the rectus all the way around (Fig. 76). This is a practice that can be resorted to in case of echinococcus or other cysts in many locations of the body where excision of the wall cannot be practised. The abdominal cavity was closed with the gauze strip brought out of the wound. In five days the gauze was removed and replaced by a rubber tube. The wound healed by primary union, but after twelve days the discharge from the tube became seropurulent, and from time to time cysts escaped on irrigation, which was practised daily with a boric acid solution.

It is now about six weeks since the operation and her general condition has remained good. The moderate amount of discharge has shown little abatement. It will no doubt continue to discharge for some months, as the cavity is held open by the rigid liver walls. Six to twelve months are sometimes necessary for the filling in of these cavities. Of course, I cannot be sure that all the cysts are out, as some have escaped since the operation, and there may be still one or more large pockets which have not been opened. Any remaining cyst may eventually be discharged and healing occur, or the process may spread and make further trouble. Another danger is that of implantation cysts in the peritoneal cavity. Despite careful walling off, a certain amount of fluid must have gotten into the peritoneal cavity. To avoid this occasional complication the operation may be done in two stages: First, suturing the wall to the peritoneum, packing the area with gauze, and then, after seven to ten days, opening and emptying the cavity.

Second Clinic, November 8, 1916

Since showing you this patient, operated on for echinococcus cyst of the liver, a marked change has come about in her condition. She continued to do well with a temperature around normal until two weeks ago, when she developed pain in the liver region and the temperature went to 102° F. The pain continued and the temperature went to 103° F. of afternoons. On the fifth day a catheter was introduced into the depths of the wound and about 1 pint of foul-smelling pus and cysts washed out. After

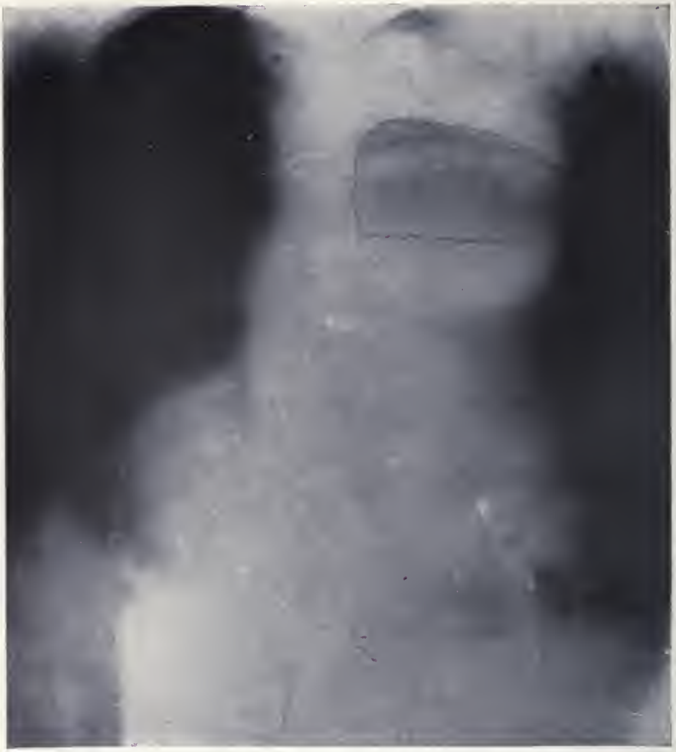

Fig. 77.—Röntgenogram (plate reversed) showing the subphrenic pyopneumothorax. The area enclosed by the dotted line represents the location of the gas; above that is the compressed lung; below is a denser area representing the liquid, and below that the location of the original liver lesion, the lower limit of which is indicated by the shadow of the safety-pin used to anchor the drainage-tube in the old subcostal wound.

this the symptoms subsided somewhat, but soon returned, and for the past five or six days have been about as before, despite the daily irrigations. The leukocytes have ranged from 12,000 to 16,000. The dulness over the lower portion of the right chest has gradually shifted upward until yesterday it extended to the second rib anteriorly.

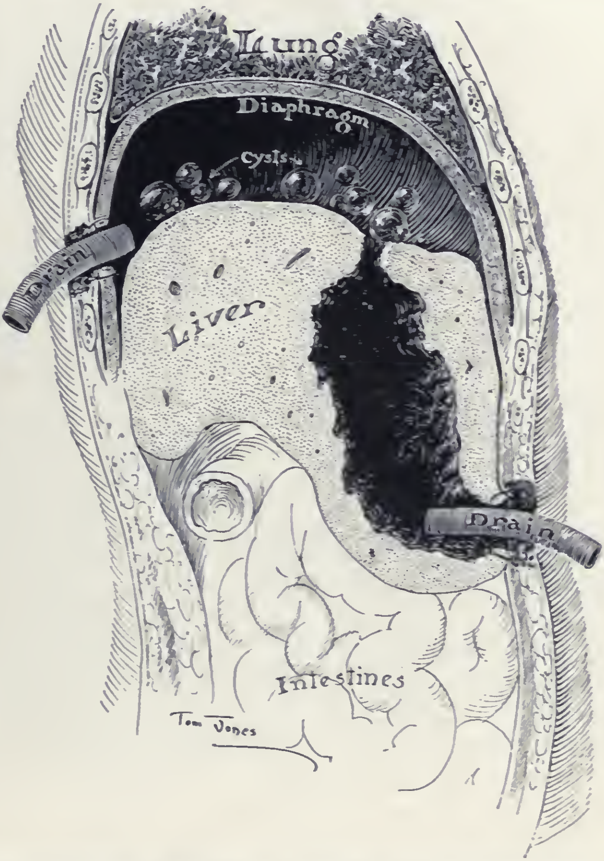

Fig. 78.—Diagrammatic representation of pathologic anatomy following drainage of the subdiaphragmatic pyopneumothorax.

The chest was fluoroscoped and a very unusual condition revealed (Fig. 77). The right lung was crowded upward and collapsed by the diaphragm, which extended to the third rib anteriorly. Beneath the diaphragm there was a dome-shaped penetrable area with a sharp line representing a fluid level below. Shaking and changing the position of the patient caused this fluid line to shift. The diaphragm moved slightly on respiration. A further physical examination of the chest then revealed dulness over the lung about the second rib, slight tympany over the third interspace and fourth rib, and dulness below the fourth rib. Splashing could be heard over the tympanitic area on shaking the patient. The diagnosis was made of subphrenic pyopneumothorax (Leyden) or an air- and pus-cavity between the diaphragm and the dome of the liver.

A transpleural drainage of the cavity was decided on. Under local anesthesia 2½ inches of the eighth rib were resected beneath the angle of the scapula. The parietal pleura was thin and transparent. The lung was displaced upward so that it lay entirely above the field, and the diaphragm could be seen pressed in contact with the parietal pleura, over which it moved during respiration. An elliptic area of the pleural cavity 2 inches long was walled off by the passage of a row of interlocking sutures through the parietal pleura and the diaphragm suturing them together. This walled-off area was then cut through into the subdiaphragmatic space, where a large cavity was found filled with foul-smelling gas and pus and hundreds of various sized echinococcus cysts. Upon irrigation it was found that this cavity communicated with the one opened at the first operation, from which the infection had no doubt extended (Fig. 78).

With the patient on her back the irrigating solution was then introduced through the old opening and the cysts and pus washed out through the new one. A drainage-tube was introduced into the abscess cavity.

Her temperature has dropped to normal since the operation and she feels very much better. As nearly as I can tell there was no extension of the disease process through the diaphragm into the pleural cavity.

THIRD CLINIC, NOVEMBER 18TH

Still another interesting complication has developed since the patient was last shown.

Following the drainage of the subphrenic pyopneumothorax the temperature dropped to normal of mornings and 99.6° to 100° F. of afternoons for four or five days. Then it went to 100° to 101° F. of afternoons and the patient developed a slight cough. The wound has been irrigated daily and cysts have been obtained

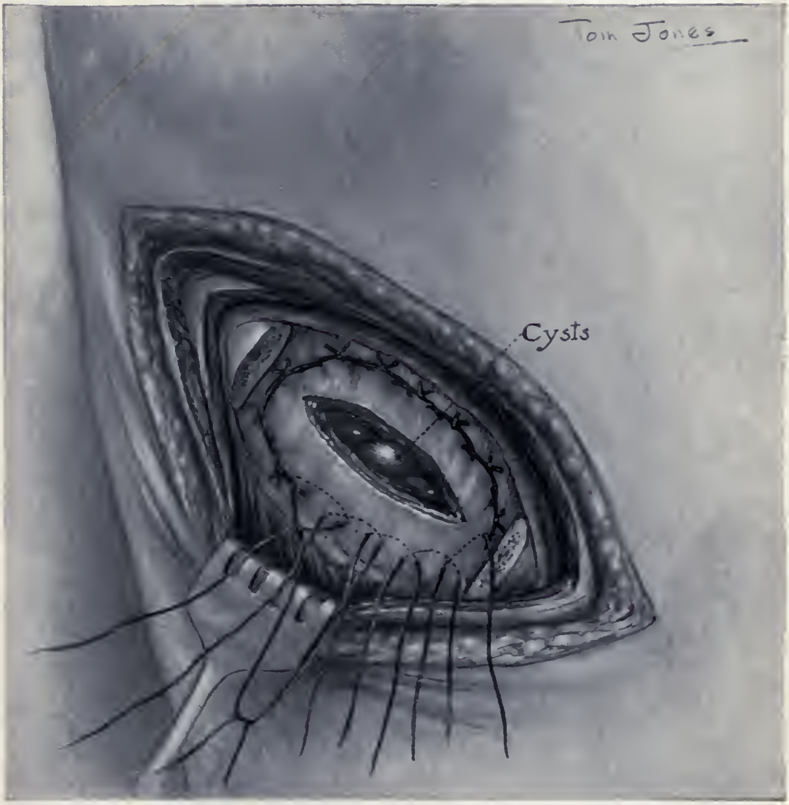

Fig. 79.—Drainage of subdiaphragmatic pyopneumothorax. About 3 inches of the seventh rib in the posterior axillary line has been resected subperiosteally. The diaphragm has been united to the chest wall by a ring of interlocking sutures and the abscess incised. Note the echinococcus cysts in the depths of the wound. The bulging noticed just above the upper angle of the skin incision indicates the angle of the scapula which has been drawn up due to the elevation of the arm above the patient's head. When the arm was brought down to the side after the operation the scapula descended upon the drainage-tubes; later adhesions developed between tissues about the incision and the scapula interfering with the motion of the arm, illustrating some of the disadvantages of drainage at that level (see text).

a number of times. The discharge is less purulent, but quite profuse.

Examination of the chest soon after the operation showed the typical findings of a pneumothorax on the right side. As the slight elevation of temperature has persisted we have examined the chest repeatedly, and recently have found evidence of fluid as well as air in the chest. A needle was introduced and a serous fluid removed which was rich in albumin and leukocytes, but contained no scolices or hooklets. At the present time there is considerable fluid in the chest and distinct splashing sounds can be heard even at a distance on shaking the patient. Here is an x-ray plate of the chest which shows the air above the fluid's distinct level and a small amount of air still present in the space beneath the diaphragm.

Apparently the hydropneumothorax arose by leakage of the transpleural wound, permitting some air and infected material to enter the pleural cavity. This was not apparent at the time, but may have occurred during the washing out of the cavity, as the patient coughed considerably during the procedure. This could have been avoided by a two-stage operation, opening the abscess two days after suturing diaphragm to parietal pleura. (A needle was introduced and 1000 c.c. of fluid withdrawn with a Potain apparatus.) By pumping out the fluid with this arrangement no air is allowed to enter the pleural cavity and the lung expands to take the place of the fluid. This hydropneumothorax should not be a serious complication unless the echinococcus has also extended through the diaphragm.

CENTRAL FIBROMA OF MANDIBLE

Summary: Patient, a young woman, with good-sized tumor of mandible which has been present four years; description of tumor; differential diagnosis of tumors of mandible; operation; histology of central fibromas of the mandible.

September 15, 1916.

HISTORY

The patient, a single woman of twenty-one years, was admitted to the Presbyterian Hospital September 13, 1916, because of a swelling of the lower jaw.

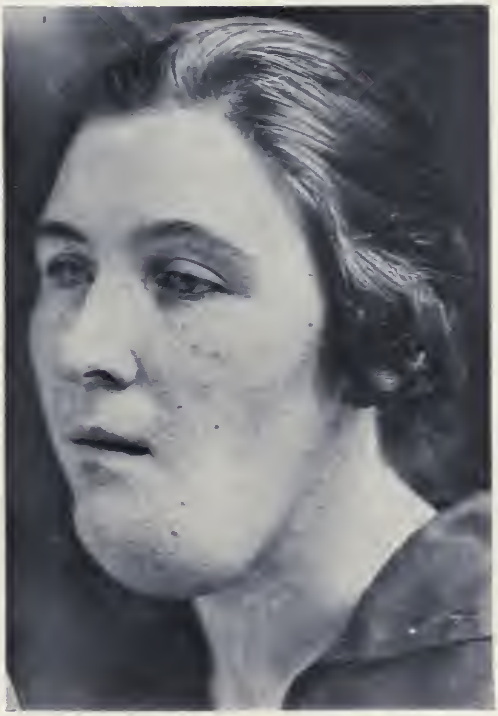

Fig. 80.—Myeloid sarcoma of jaw.

Four years ago a painless swelling appeared on the left side of the jaw anteriorly. This gradually and silently increased in size until it has now reached the dimensions of an orange. There has been no pain in connection with the swelling and no disturbance in chewing or swallowing. There has been some feeling of weight in the jaw as the tumor has approached its present size (Fig. 80).

The general health of the patient has remained good, her weight remaining constant for the past two years.

EXAMINATION

Examination shows a rather frail, fairly well-nourished young woman. There is no evidence of cachexia or emaciation. There is a smooth tumor mass in connection with the left side of the lower jaw about the size of an orange. It involves the body of the jaw and extends from the second molar on the left side anteriorly and around to the bicuspid on the right side. It is bony in consistency. No parchment crepitation can be felt. On inspection and palpation within the mouth the tumor is found to extend upward on the alveolar process about the base of the teeth and does not involve the overlying mucous membrane. There is no malalignment of the teeth. The veins over the tumor are slightly dilated. There is a palpable gland in the left submaxillary triangle about the size of a bean, which raises the question of metastasis. No other enlarged glands can be felt. The *x*-ray picture shows an expansile oval swelling of the jaw with a thin cortical rim and casting a faint shadow in its central portion. There are some irregular central shadows, and it is difficult to say whether they are due to irregularities in the cortical bone or to internal trabeculæ (Fig. 81).

This case presents an interesting problem in diagnosis. That it comes under the general heading of tumor and began in the interior of the body of the mandible there can be little room for doubt. We can divide the central tumors of the jaw into those which arise from the tissues of the jaw proper and those which arise from the dental system.

Of the tumors from the tissues of the jaw the benign are less frequent than the malignant. The commonest of the benign tumors is the fibroma or, as it is sometimes poorly called, internal epulis. It develops slowly and painlessly, producing a circumscribed expansile swelling of the jaw. As the bone is destroyed on the inside the periosteum forms a new layer on the outside, so that the tumor is practically always surrounded by a thin bony shell even when it reaches large size, which requires many years. The tumor is made up of fibroblasts with occasional giant cells and bony trabeculæ, but the tendency to ossification is very slight. Degeneration with cyst formation may occur in the larger tumors. Transformation into slowly growing sarcomas sometimes results,

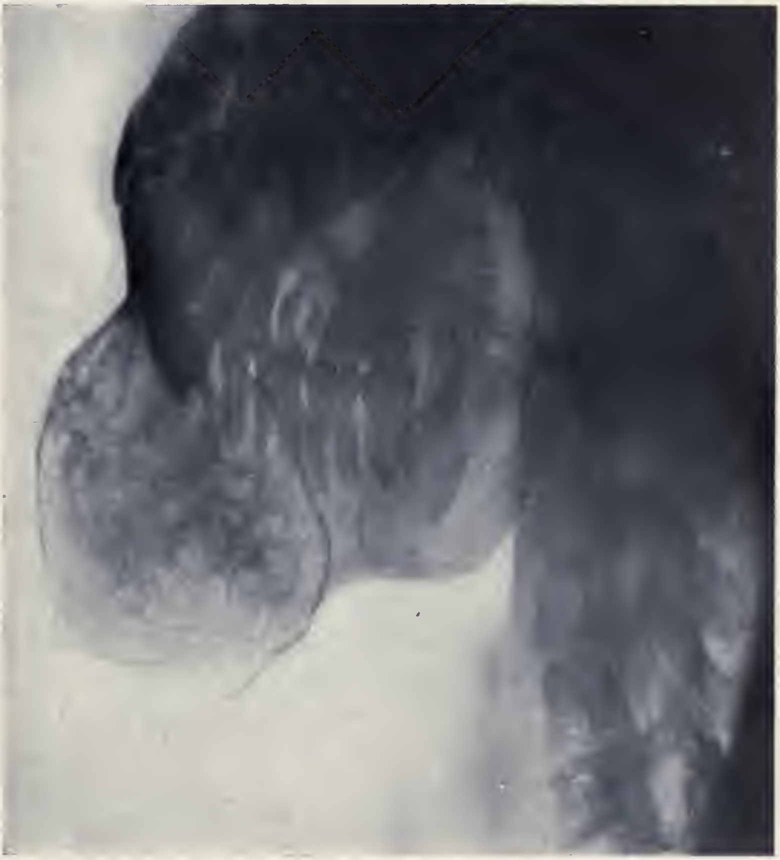

Fig. 81.—Central fibroma of mandible. Note the shadows suggestive of bony trabeculæ dividing the interior of the tumor into numerous cavities.

and every fibroma of the jaw should be looked upon as potentially malignant. Pure chondromas of the jaw are extremely rare and the presence of cartilage in a tumor usually means that it is a chondrosarcoma. Myxomas and angiomas are almost unknown in this location. Osteoma of the lower jaw is not so rare, but usually occurs as an exostosis, which makes its diagnosis easy. The expansile type of exostosis makes a tumor similar to this case, but the *x*-ray shows a dense bony interior in contrast to the faint shadow cast by this tumor.

Central sarcoma of the lower jaw usually belongs to the giant-celled type. It is slow-growing, expansile, erodes the bone from the interior, and possesses very little tendency to ossify. A thin cortex is formed about it as it increases in size. This may not keep pace with the tumor growth, which in places will break through, while in other places a parchment crackling may be felt over it. There is little tendency to metastases and the prognosis after careful removal is very good.

Rarely a round- or spindle-celled central sarcoma is seen with its more malignant tendencies.

A variety of jaw tumors arises from the dental system, but practically only one form reaches the dimensions presented by this case. Odontomas are, as a rule, very small. Root cysts and follicular dental cysts rarely surpass the size of an egg. *x*-Ray usually shows rudimentary teeth in the follicular cysts. Multilocular cystoma (or in its solid form, adamantinoma) if left untreated usually forms a large tumor of the jaw. It arises from the peridental epithelial debris of Malassez, which comes from the enamel organ. The solid form is rare. The tumor arises in the central portion of the jaw as a mass of epithelium which resembles histologically that of the enamel organ of the fetus. As it increases in size, cysts form which may be independent, but which usually are multilocular and may even be separated by bony septa. Such a multilocular cyst may reach enormous dimensions, as in the case operated on in this hospital by Dr. Dean Lewis and reported in "Surgery, Gynecology, and Obstetrics," January, 1910. Fluctuation may sometimes be elicited and parchment crepitus is common.

Narrowing it down, the diagnosis in this case would seem to lie between central fibroma, myeloid sarcoma, and multilocular cystoma. Because of the absence of bony septa I feel that it is probably not multilocular cystoma. It is hard to differentiate between the first two conditions, as the period of development (four years) would be consistent with either. However, I feel that it is most likely a myeloid giant-celled sarcoma.

OPERATION

A horseshoe-shaped incision is made along the lower border of the tumor and extended backward on the left side over the submaxillary triangle. The skin-flap is reflected anteriorly to the mucous membrane of the mouth, which is then carefully dissected off beyond the limits of the tumor to the margin of the gum. In one place it is nicked and the mouth cavity opened. This is at once closed with a silk suture. Posteriorly the muscles attached to the symphysis of the jaw are cut away and the mucous membrane carefully separated by blunt dissection. The tumor

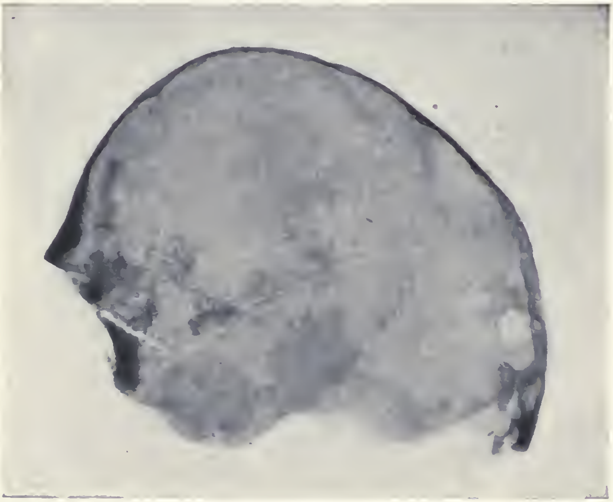

Fig. 82.—Central fibroma of mandible. Röntgenogram of a segment of the tumor showing that the subdivision by bone trabeculæ (see Fig. 81) was only apparent, due to the irregularities of the inner surface of the bone shell which surrounds the tumor.

is now freed of its covering. I want to preserve the alveolar portion of the mandible, including the teeth and without breaking the mandible, so that there will be no malalignment of the teeth. With a motor saw I cut the bony cortex at the limits of the tumor. I fear that the alveolar process would be broken if a hammer and chisel were used. I have to break the thin cortex posteriorly by pressing on the tumor, as the saw cannot be used in that location. Now that I have succeeded in removing the tumor, I will trim up the margins with a bone-cutting forceps and curet the bony surface that is left. You see that it is a solid tumor with some small cavities about the limits through which I have broken. It does not look very malignant and until it is cut open I will not venture a diagnosis. Now that the remaining bony surface has been thoroughly cureted, I will anchor the detached muscles as well as possible to the soft parts of the chin. (Skin closed with

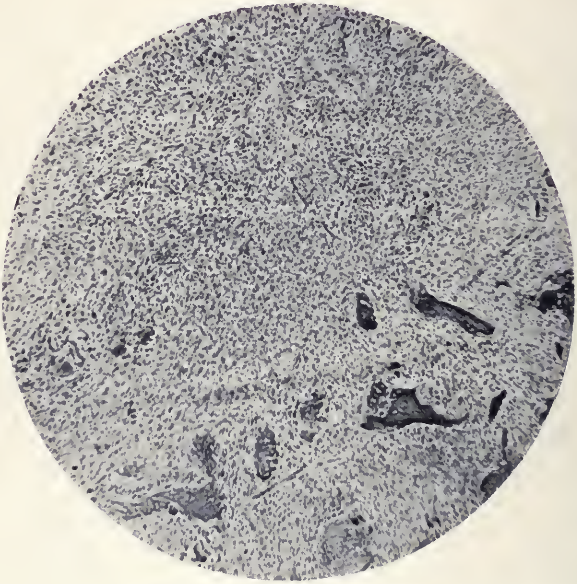

Fig. 83.—Central fibroma of mandible. Photomicrograph showing typical structure—islands of bone (dark areas) and osteoid tissue (solid areas of medium tint) embedded in a very cellular mass in which are degenerating foci (non-staining areas especially numerous in upper right quadrant).

interrupted silk sutures—gutta-percha drain.) I did not remove the contents of the submaxillary triangle because this process does not look malignant.

Postoperative Course.—The wound became slightly infected, but healed in three weeks, leaving considerable depression of the chin.

Pathologic Report.—The tumor consists of an outer bony covering and a firm but soft interior, which grates in places when cut. There are no cysts or areas of degeneration within the substance of the tumor proper. Microscopically, it consists very largely of cells resembling fibroblasts, but without any mature areas such as one may see in a fibroma. Scattered bony trabeculæ and islands of osteoid tissue are to be seen, although the amount of ossification is slight, as is shown by an *x*-ray picture of a segment sawn out of the tumor. It will be seen that most of the shadow is cast by the cortical rim of bone (Fig. 82). An occasional giant cell is to be seen. There are no mitotic figures or deeply staining nuclei (Fig. 83). From the pathologic findings I would classify this tumor as a central fibroma of the jaw with slight ossifying tendencies. One cannot be sure that had the tumor been left alone it would not eventually have become malignant, in which case it would be classed as a myeloid sarcoma.

223

SURGICAL CLINICS OF CHICAGO

Volume 1 Number 2

CLINIC OF DR. A. J. OCHSNER

AUGUSTANA HOSPITAL

CARCINOMA OF THE BREAST: DIAGNOSIS, INDICATIONS FOR OPERATION, AND TECHNIC OF THE RADICAL CURE

Summary: Signs and symptoms of carcinoma of the breast—the wisdom of removing every new growth—wide-spread metastases following massage or too frequent examination; details of the radical operation; accidents and complications—how to avoid them—the value of gauze dissection; closure of the wound without tension on the flaps—the dressings and after-treatment; use of Röntgen ray; when to apply skin-grafts—the technic—precautions to be observed—the wire-basket dressing.

HISTORY

THE patient, a single woman of forty-one, by occupation a teacher, was admitted to the hospital October 8, 1916, because of a mass in the left breast.

Her family and past histories are negative. Menstrual history is also negative. Habits are good. There has been no loss of weight.

In the summer of 1915 she noticed a slight retraction of the left nipple, which has been gradually increasing. A hard nodule beneath the nipple was noticed a few weeks later, which has slowly increased in size. About one month ago she began to have sticking pains in the breast. There has been no discharge from the nipple. She has nursed two children normally. She does not remember ever having been struck in this region. Five or six years ago she was treated for goiter, with good result.

PHYSICAL EXAMINATION

The patient is a well-developed and well-nourished woman with good color. The tonsils are hypertrophied and there are a number of patulous crypts. The eyes react to light and accommodation. There is a slight, symmetric, diffuse enlargement of the thyroid gland, but there are no signs of pressure or of hyperthyroidism present. The heart and lungs are negative. The nipple of the left breast is almost completely buried, due to the retraction. The breast is quite firm beneath the nipple for a distance of 1 inch, and in this region can be palpated a hard, slightly tender, infiltrating mass attached to the nipple and to the underlying breast tissue. There is a slight moisture about the nipple. No other masses are palpable in either breast. There is a small hard lymph-gland palpable deeply in the left axilla. Otherwise the examination is negative.

COMMENTS AND OPERATION

Dr. Ochsner (October 9, 1916): This is a very early carcinoma of the breast. You see the retraction of the nipple. There is an area here of only about 3 cm. that is indurated. We never leave a growth in the breast under any condition, because we have seen a very large number of cases in which an apparently harmless growth was left for a number of years, and then suddenly, without any apparent good reason—probably after some little traumatism—the condition changed into a malignant condition. On the other hand, of all the non-malignant growths which we have removed early, before there was any suspicion of malignancy, none of those that we have had the opportunity to follow up have ever suffered from malignancy. Therefore, on one hand, we have the experience of a great many cases in which these growths have been left and in which malignancy has occurred, and, on the other hand, we have a great many cases in which these growths have been removed and in none of them has malignancy occurred. It would consequently be wise to do just what we are doing—remove every growth of the breast.

It is in cases just like the one before us that the surgeon has the greatest responsibility, because, if the operation is performed with the same thoroughness that a surgeon would employ were he dealing with an advanced case, the patient is practically certain to remain free from recurrence. On the other hand, if the surgeon decides to make a very limited operation because the palpable tumor is so small, then the patient is practically certain to die as a result of the occurrence of metastatic growths.

There are several very definite dangers to which a patient in the condition of the one before us is exposed. The first of these lies in the tendency that many surgeons have of manipulating these growths many times while they are trying to decide whether or not an operation is indicated. If the surgeon is violent in his manipulations, then the patient is very likely to die from metastatic growths in the liver or elsewhere in the body. During the early days of osteopathy I encountered a considerable number of cases that had been treated by osteopathic massage, in which, apparently, the infectious material had been set free as a result of these manipulations. During recent years the osteopaths no longer massage malignant growths, and for some years I have not encountered any of these cases.

We have observed a number of cases in which the growth remained stationary until the patient began to have it examined frequently, and, either as a matter of coincidence or as a result of the manipulations practised during these examinations, the patient reported that the growth had increased more within a few weeks than it had during many months previously. This was especially true in cases in which oils and liniments had been rubbed into the breast in the hope of reducing the size of the growth. It is, of course, possible that the fact of an increase in size had induced the patient to seek advice from the physician.

I would also strongly caution the doctor against removing a portion of the growth for the purpose of making a microscopic examination unless this were done by means of the electric cautery or the Paquelin cautery, because I have encountered many cases in which the removal of a small portion of a growth was followed by death of the patient from metastases.

Our usual incision is the one introduced by Dr. Rodman, as shown in Fig. 84. We begin far enough toward the median line with our incision so as to be quite sure of removing all of the tumor tissue. We make a vertical incision at right angles to the arm which is extended in an upward and outward direction. Then we lay bare the axilla. We do this notwithstanding the fact that this growth is very small, because it is just in these cases that we have the best chance of permanent recovery, provided the operation is performed with the same thoroughness as if the case were far advanced. We are careful to remove a large piece of skin overlying the breast in order that we shall not have recurrences in that tissue, and for this reason the lower incision is made 3 cm. distant from the nipple. We turn

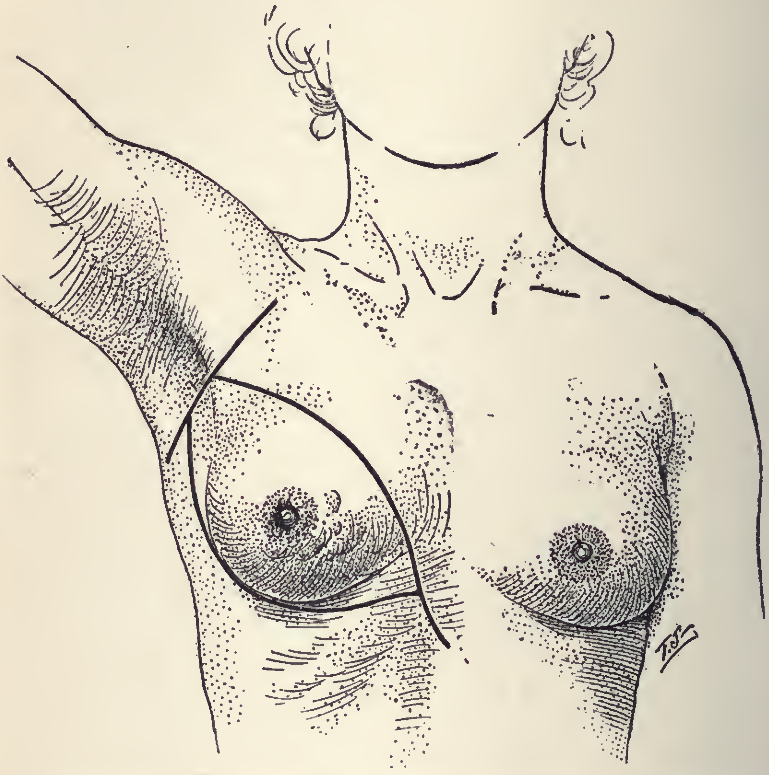

Fig. 84.—Rodman incision used, including skin over the entire breast. Note transverse portion inferior to axilla. Median end of incision extends to the xiphoid process.

back our skin-flaps above and below the breast so that we may remove all the tissues beneath them that might contain carcinomatous material. Every blood-vessel is caught carefully, so that practically no blood is lost. We are now dissecting up the pectoralis major muscle, and as we proceed you can see how the vessels perforate the intercostal spaces. Whenever possible one should grasp these blood-vessels before they are cut. It is of the very greatest importance to guard against pushing the hemostatic forceps through the intercostal space and so opening the pleura, an accident which has frequently happened and is very likely to happen if one does not bear in mind its danger. Such a puncture, however, can be easily and quickly closed with a mass of vaselin so as to prevent the occurrence of a pneumothorax. In applying forceps one must guard especially against making traction after clamping them. Many surgeons have a habit of making traction on hemostatic forceps after they have been applied in order to make sure that they have grasped the vessels in a satisfactory manner. Ordinarily it may be perfectly safe, but in this portion of the operation it is not at all safe because of the danger of tearing off the branches of the intercostal vessels which may retract, and are very difficult to grasp after they have once been torn. What has been said about the intercostal arteries applies to an even greater extent to the mammary artery and vein.

Notwithstanding the fact that we have a very small tumor here, we remove every particle of the pectoralis major muscle. We have guardedly come down upon the pectoralis minor muscle, and just where the pectoralis major crosses the pectoralis minor we always encounter this group of blood-vessels—the pectoral branches of the acromiothoracic artery and vein and the long thoracic artery and vein. These we grasp between two pairs of forceps and ligate at once for fear of tearing them and to prevent tearing a hole into the axillary vein. Now I place my finger underneath the pectoralis minor muscle, directly along the anterior surface of the vein, so as to free this muscle from its attachment to the ribs. It is now entirely separated. I sever the proximal attachment to the ribs in this way, and by lifting up the pectoralis minor muscle I expose the entire remaining portion of the axilla. I remove all the fat in the axilla by means of a gauze sponge. By rubbing this gauze over the tissues I am able to remove every particle of fat and all the lymph-nodes, leaving the tissues in the axilla absolutely clean (Fig. 85). The axillary artery and vein are exposed quite up to the clavicle, exposing also the third portion of the subclavian artery and vein. Every one of the little vessels is exposed in this way by means of gauze dissection. Each vein is

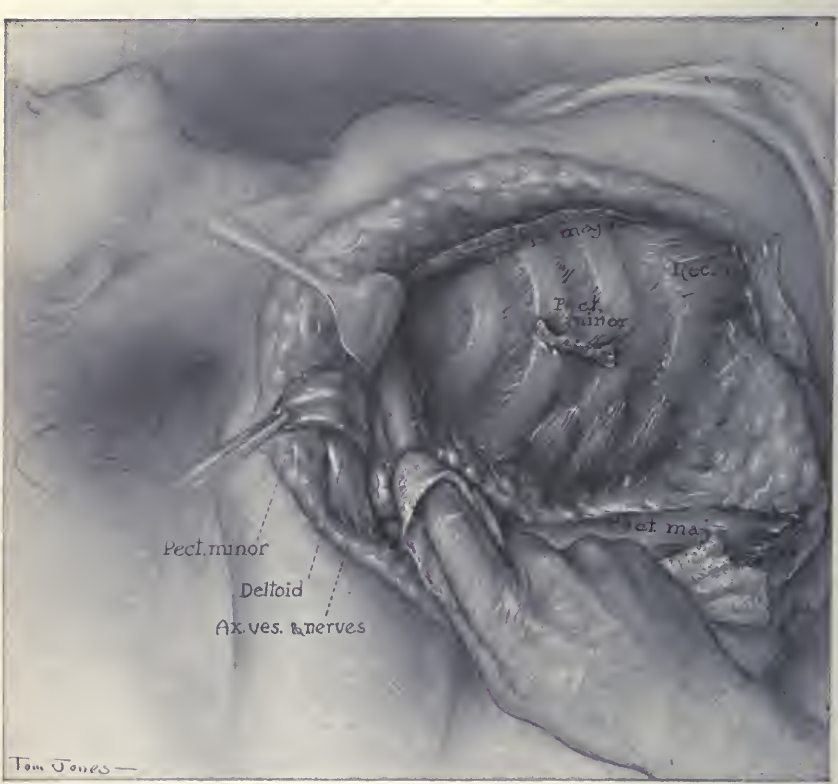

Fig. 85.—Showing method of clearing the axilla of all lymph-glands and fat by means of gauze dissection with the finger. The breast together with the pectoralis major has been dissected from the chest wall, beginning medially and continued downward and laterally. The origin of the pectoralis minor muscle has been severed.

then caught between two pairs of forceps, is sectioned between the forceps, and the end which remains attached to the axillary vein is at once ligated with very fine catgut ligatures. There is no operation in which careful manipulations are more important than here. If the surgeon is careless or shiftless in his manipulations he is certain to do mischief. If he pulls too hard, or if he is not careful in tying his sutures, or in making this gauze dissection he is liable to do harm that is difficult to repair. Should we, however, be so unfortunate as to injure the axillary vein, we should at once compress it above and below the point of injury and accomplish its repair with a series of fine silk sutures. We expect to have a perfectly functionating axillary vein as a result of this step. The method of suturing these veins was introduced by Dr. John B. Murphy many years ago, and I have practised it where the veins in this or in any other operation have been injured. I think we have only had 2 cases in my experience where the axillary vein was injured. However, we have had several experiences in which the deep jugular vein was injured in operations upon the neck, and in which the vein was repaired by the method I have just described.

In order to prevent unnecessary compression of the axillary vein following the operation, we cut off the proximal end of the pectoralis minor muscle, leaving the distal end attached, and so preserving a sufficient portion of the muscle to cover the axillary vein. We suture the cut end of this muscle to the intercostal muscles, and in this way effectually protect the axillary structures from cicatricial stricture. Since using this method we have had very few cases of postoperative edema of the arm. We have never had a recurrence of carcinoma in the stump of the muscle, although we have applied this method many times since it was first introduced by Dr. N. M. Percy, of our clinic, some fifteen years ago.

We have removed the entire breast together with the pectoralis major and the proximal end of the pectoralis minor and all the fat and lymph-nodes in the axilla (Fig. 86). When you look at this specimen (indicating the excised breast and contained tumor) you see we have a carcinoma that is less than 1 cm.

in thickness and not more than 2½ cm. in width. You will also notice these small, hard, shotty, carcinomatous axillary glands. One can see in this wound the intercostal muscles exposed throughout the entire chest wall on this side. The axillary artery and vein are also exposed throughout their course except where covered by the pectoralis minor muscle. We catch every little vessel very carefully so that there can be no unnecessary loss of blood and no collection of blood and serum beneath the skin-flaps.

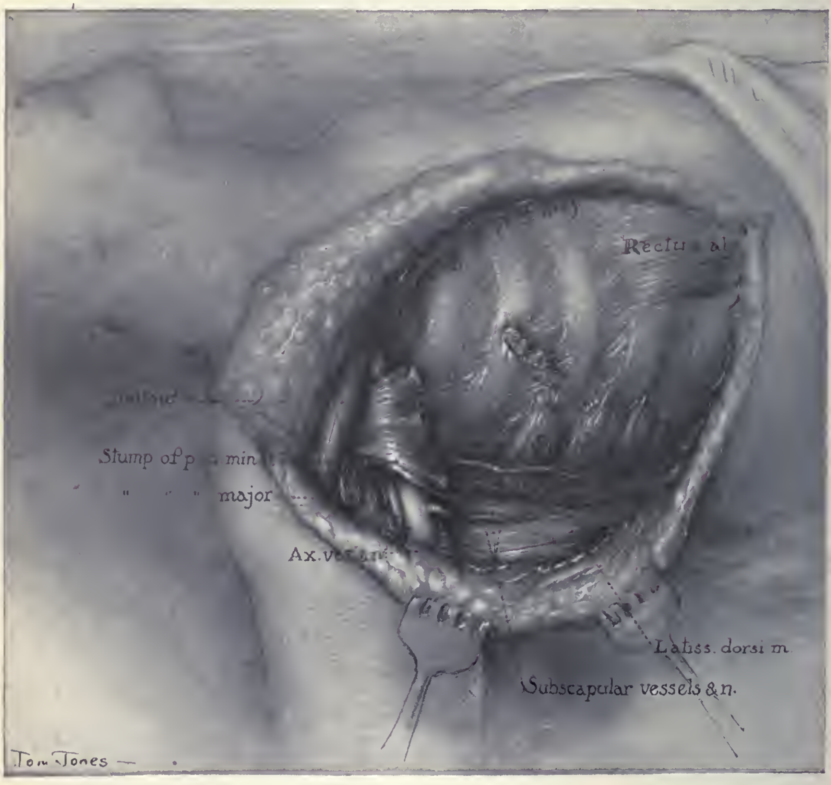

Fig. 86.—Breast removed. Pectoralis minor muscle sutured so as to cover axillary vessels. Note the clean dissection of chest wall which can be obtained only by gauze dissection.

Drainage.—In order to prevent the collection of serum beneath these large skin-flaps I make a small stab incision in the middle of the axilla and just at the lowest corner of the wound. Through this incision I now pass two small split-rubber drainage-tubes. One of these is placed near the axillary vessels and the other directed toward the epigastrium. These drains

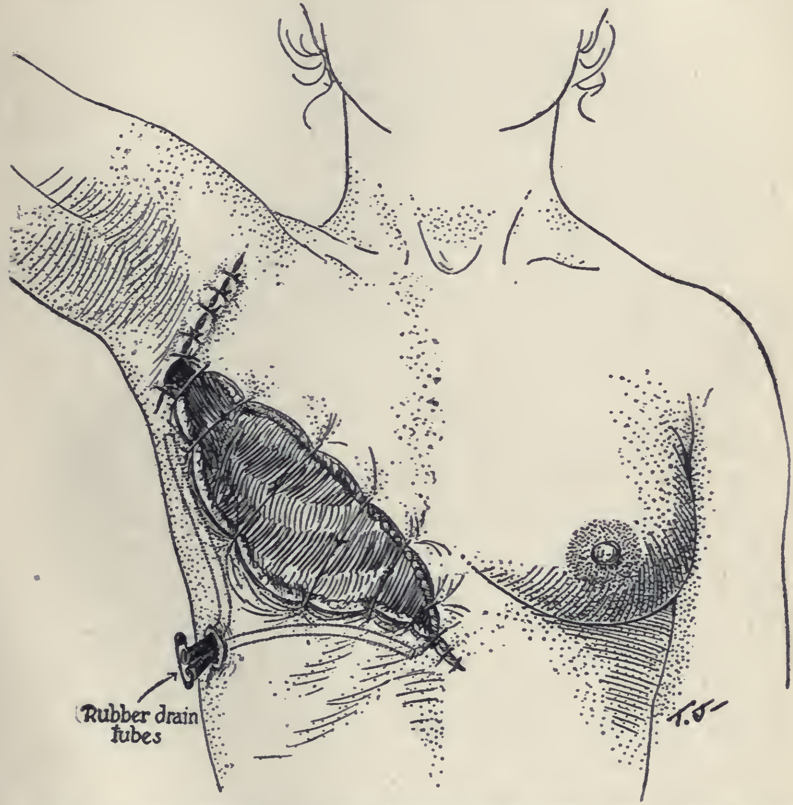

Fig. 87.—Showing wound closed with silkworm sutures. Very little if any tension is made on the flaps because of danger of necrosis of the flaps. Two split-rubber tube drains inserted through a stab incision in the lowest corner of the wound, one passed to the axilla and the other to the epigastrium.

will be removed on the third day, when there will have been fibrinous adhesions between the surfaces of the skin-flaps and chest wall, thus preventing the further collection of serum.

The flaps are now approximated as in Fig. 87 by means of a number of interrupted silkworm-gut sutures, great care being taken to leave the edges of the wound at least 1 cm. apart. By drawing these sutures tightly it would be possible to make a perfect coaptation, but the tension would result in interference with the arterial circulation to such an extent that little new blood would be carried to the edges of the wound by the return circulation. The lymphatic circulation would be interfered with to a much greater extent, and as a result of this the skin would soon become edematous, and the free edges of the flap being closely sutured, there would be no possibility for the accumulated lymph to drain away from the flaps, and, undoubtedly, a considerable portion of each flap would become necrotic and a large area would remain without skin covering.

On the other hand, by leaving the edges sufficiently apart to permit the lymph to drain out of these flaps, and at the same time to make the tension not sufficient to prevent return circulation, all the skin that has been left will remain and the small space left between the edges of the wound will heal spontaneously in a very short time. In cases in which the skin-flaps are even less able to cover the denuded surface it is quite proper to leave a considerable portion uncovered. In the case before us a triangular surface 4 cm. wide at its widest portion, and 7 cm. long, as shown in Fig. 88, will have to remain uncovered.

In order to prevent the free edges of the skin-flap from curling in it is well to insert a few horsehair sutures between the silkworm-gut sutures. It is of the greatest importance in these cases to avoid tension. At the conclusion of this operation the wound does not look nearly so attractive as it would had we applied a greater amount of tension and secured absolute coaptation of the wound edges, but within a week only a very small area of this wound surface will remain open, while in the other case by that time undoubtedly a large portion of the skin-flaps would be necrotic.

In order to still further prevent the occurrence of edema we make a series of small incisions extending almost, but not quite, through the skin-flaps in a parallel direction with the line of sutures. This reduces the tension and permits the lymph to escape at the same time. All of these small incisions will heal spontaneously within a short time.

Application of Dressings.—It is important to bear in mind the method of dressing these wounds. If only a small amount of dressing material is placed on these wounds, and this is held in place by means of a very tightly applied bandage, the pressure will interfere seriously with the circulation in the flap and may cause necrosis. It is therefore advisable to apply a very large dressing surrounded by a soft gauze roller bandage, applied with only sufficient tension to hold the dressing securely in place, but not sufficiently tight to cause necrosis. The dressings should overlap every portion of the wound sufficiently, so that they cannot be displaced by the moving about of the patient.

After-treatment.—The patient will be put to bed and will be permitted to drink freely of hot water. Normal salt solution will be given by means of the proctoclysis method introduced by Dr. John B. Murphy. She will be permitted to sit up in bed to-morrow morning, and to sit up in a chair outside of bed from twenty-four to thirty-six hours after the operation. The drainage-tubes are removed on the third day. On the fifth to the seventh day the superficial sutures are removed and the deep sutures on the twelfth day.

Röntgen Ray Treatment.—This patient received an intensive *x*-ray treatment yesterday and a second treatment this morning before the operation was begun. She will receive one further *x*-ray treatment every day for the next four days, so that she will be given six intensive *x*-ray treatments in this series. It is not necessary to fear any harm to the healing of the wound because of this *x*-ray treatment, as it does not seem to have any harmful effect whatever. Had we been able to close this wound entirely we would have given the patient another series of *x*-ray treatments two weeks after finishing the present series. It will, however, be necessary to apply skin-grafts to this wound, and the application of *x*-ray seems to interfere with the growth of skin-grafts that have recently been applied. Consequently, we will postpone the application of our skin-grafts until the case has received a sufficient number of *x*-ray

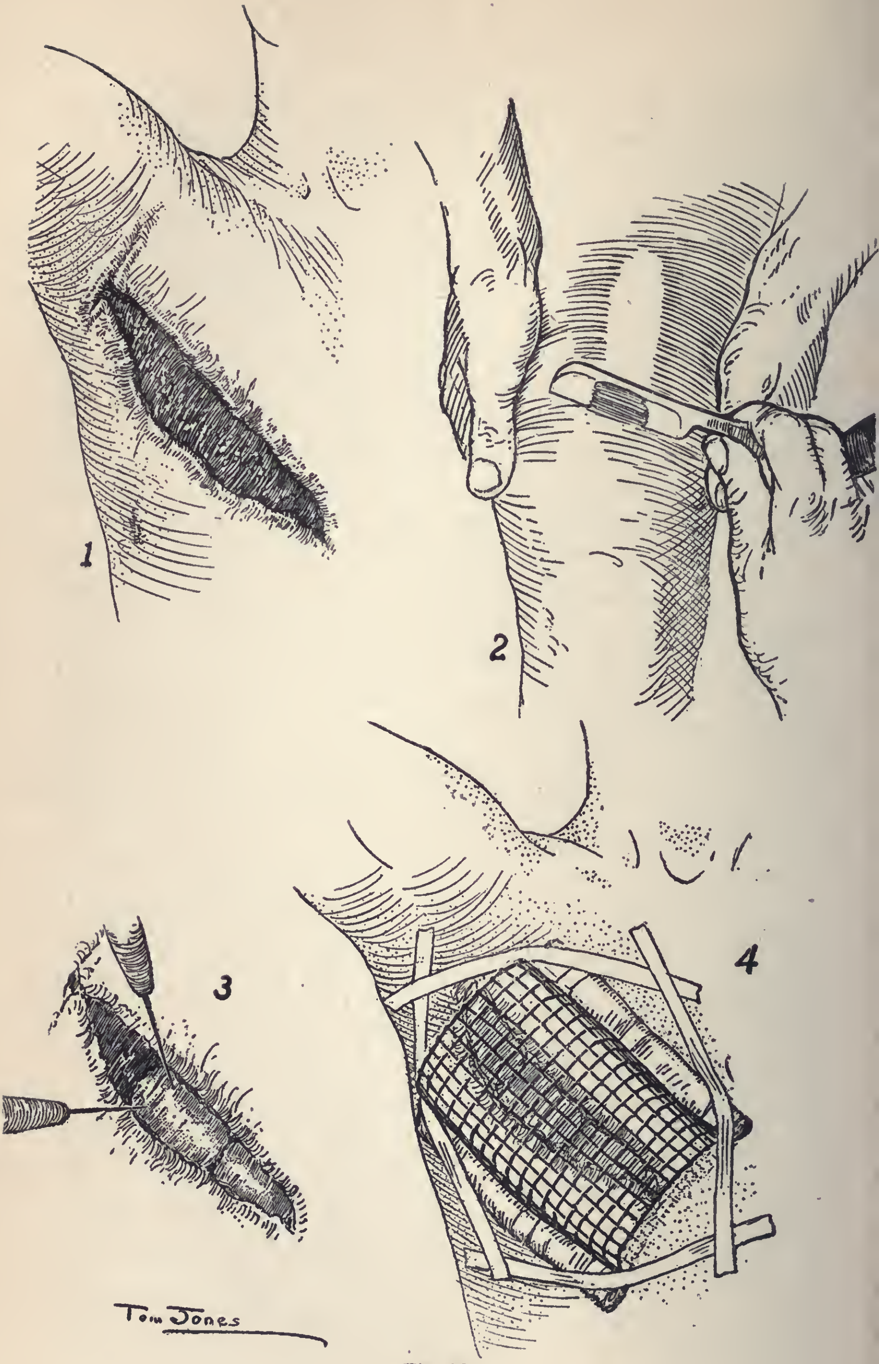

Fig. 88.

treatments to destroy any remnants of malignant tissue which might be left at the conclusion of this operation. Crile and others have insisted that x-ray is more effective in open wounds, and consequently we will permit this patient to rest for two weeks after the conclusion of the present series of x-rays, and then we will administer six more daily intensive x-ray treatments, after which time we will cover the raw surface with skin-grafts.

Comments by Dr. Ochsner (November 2, 1916).—*Skin-grafting.*—We have here a granulating surface, triangular in shape, 12 cm. long and 2½ cm. wide, as in Fig. 88, 1. The surface is perfectly smooth and perfectly clean and the granulations are firm in character. Twenty-four hours ago the whole surface was carefully painted with strong tincture of iodin. At that time the granulations were not quite so smooth and even as they are at the present moment, so that we attribute the present condition to the action of the tincture of iodin.

For a number of years many surgeons recommended the removal of all of these granulations by means of a sharp curet, so that the grafts might be applied to the underlying raw surfaces. We have found, however, that our results are very satisfactory if the skin-grafts are applied directly to these granulations.

A surface of the skin from which the graft is to be taken on the outside surface of the patient's thigh is cleansed either by soap and water and alcohol, or by washing with benzin and applying tincture of iodin lightly to the surface, and later removing most of the iodin by means of a gauze sponge and alcohol.

Fig. 88.—1, Wound three weeks after average breast amputation. Healthy granulations in base of wound. Ready for skin-grafting. 2, Removing a thin layer of skin from the thigh by means of a razor. An assistant's hands on either side of the thigh stretch the skin taut. Note the graft collecting on surface of razor. The graft is then deposited upon the wound directly from the razor. 3, Spreading of the grafts over the wound by means of two needles. The graft is never lifted again from the surface. Care must be used not to cause bleeding by manipulation of the needles. 4, Wire basket, the edges covered with gauze, fastened by adhesive strips to the chest wall in order to protect the wound and grafts from dressings.

An assistant then stretches the skin between the two hands over the femur, as in Fig. 88, 2, so that the portion to be cut is absolutely tense. A very sharp razor, of the ordinary pattern used by barbers for shaving, is then placed at right angles to the femur, and by means of a quick sawing motion a strip of the desired width and length is obtained, the cut portion doubling up on the side of the razor.

Care should be taken to cut just deeply enough to include the top of the papilla in the ribbon. This produces only a very slight amount of bleeding, and the surfaces from which the grafts have been cut will be perfectly healed in a few days.

Some years ago my brother made a very large number of observations in skin-grafting in our clinic, and found that it was possible to obtain nearly 100 per cent. of perfect results by cutting the skin-grafts absolutely dry, using dry skin from which the grafts are cut, a dry razor, and applying them to dry granulating surfaces. He also found that by following this plan the edges of the ribbons of skin would unite so closely that it was impossible to determine where one ribbon began and the other ended. We have followed this method for a period of twelve years in a very large number of cases and have found it very satisfactory.

After a ribbon of sufficient length has been cut, the edge of the razor is tilted upward, and by a few sawing motions the end of the ribbon is cut off and the entire ribbon has been piled up on the side of the razor.

The spreading of this ribbon upon the raw surface is greatly facilitated by placing the razor flat upon this surface, and with the blunt end of a fine needle pulling the edge of the ribbon which was cut last down upon the raw surface and sliding the razor over the raw surface while the ribbon is being drawn down upon this surface. In this manner, by the time the last portion of the ribbon slides off the razor the spreading has virtually been accomplished. There are little finger-like projections along both edges of the ribbon which are likely to fold under the central portion. By using two fine probes or two ordinary sewing-needles, held by their pointed ends in hemostatic forceps, and using the ends containing the eyes for spreaders, one can readily unfold the entire ribbon so that all of the little bands are spread to their fullest extent by holding the ribbon with one probe and pressing upon the surface of the edges with the other. As many ribbons of an appropriate length should be cut as are required to cover the wound. It is important to unroll all of these serrated edges to their fullest extent, because every one of these little projections will cover a surface with skin. It is not wise to try to lift up these little serrated edges, because one is likely to be unsuccessful and to injure the granulations and cause troublesome bleeding. Occasionally small air-bubbles form underneath the skin-grafts. These should be carefully pressed out so as to leave the graft in perfect apposition with the underlying granulations. Almost immediately the blood-vessels in the skin become filled with blood from the granulations and take upon themselves a pinkish appearance.

It is important not to dress the granulating wound with vaselin or any other oily substance immediately before skin-grafting is done, because the vaselin is likely to prevent the adhesion of the skin-graft to the granulation tissue, and in this way success will be prevented.

Dressing.—Many different methods of dressing have been employed, but we have found it most satisfactory to construct a basket-like apparatus out of wire-netting, sufficiently large to extend beyond the edges of the wound. Gauze pads are then folded and placed about the wound at a distance of 2 or 3 cm. and held securely in position by means of small rubber adhesive strips at a point at which the edge of the wire basket is intended to rest, so as to prevent discomfort and harm to the skin from pressure due to the edges of the wire basket. The latter is then placed over this surface in an inverted position so that there is a space of 3 or 4 cm. between the bottom of the basket and the surface of the wound. The basket is held in position by means of rubber adhesive plaster and then it is covered by means of gauze and cotton, which will prevent any contamination of the wound. The grafts in this manner are left in contact with the granulating surface entirely free from dressings and thoroughly protected from injury from without (Fig. 88, 4). Within a week they will have permanently covered the entire surface with good skin. It does not seem wise, however, to apply *x*-ray treatment for about a month. After this time it is safe to repeat this form of treatment if it is indicated.

INTRA-ABDOMINAL STRANGULATED INGUINAL HERNIA

Summary: A patient, seventy-seven years of age, who had had a right inguinal hernia for forty years and a left inguinal hernia for six years, was brought to the hospital presenting the signs and symptoms of intestinal obstruction. A probable diagnosis of carcinoma of the sigmoid flexure was made and immediate relief was afforded by colostomy; twenty days later return of symptoms necessitated a second operation.

Positive signs of intestinal obstruction; the importance of withholding cathartics; gastric lavage; choice of the anesthetic; the Moynihan tube—its value and the technic of its use; operative reduction of intraperitoneal strangulated hernia; details of the after-treatment.

History.—A man, age seventy-seven, was brought to Augustana Hospital on a stretcher September 2, 1916, complaining of abdominal pain and distention. His family and past histories are negative.

Present Trouble.—Forty years ago, while lifting a heavy load, he noticed a bulging in the right groin which was aggravated by standing or coughing. He has worn a fairly satisfactory truss on that side during the past forty years. Six years ago he noticed a similar swelling on the left side, and since then has worn a double truss. The rupture on the right side has occasionally slipped past the truss and he has had trouble at times in reducing both herniæ, but so far has always succeeded. The right hernia, he says, never becomes larger than a hen's egg, and the left is somewhat smaller.

Since about five years ago he has noticed that the stools were of very soft consistency and never were formed. At times he has passed red blood, which, he thinks, was due to his hemorrhoids. He has lost about 7 pounds in weight during the past four years.

Twelve days ago he had cramp-like pains in the entire lower abdomen, lasting about an hour and relieved by a bowel movement. One week later he had a similar attack, which was relieved in the same way. The next day, at noon, he went to bed because he felt weak and dizzy, but no pain. The next day he had pain and the bowels would not move, although he had desire. Four days ago the abdomen became distended and he became nauseated, but did not vomit. There has been no change in the herniæ and no pain in either groin. At present he is suffering with a grumbling pelvic pain, marked abdominal distention, and obstipation.

Physical Examination.—A well-developed but emaciated elderly man, with an oily yellowish-colored skin, suggestive of low-grade toxemia. Extremities cool and slightly cyanosed. Examination otherwise negative except for the abdomen and groins.

The abdomen is markedly distended and tympanitic. No definite points of tenderness can be found and no masses are palpable. Both inguinal rings admit tips of two fingers and there is marked bulging upon coughing. Both herniæ, however, are easily reduced. Proctoscopic examination of 32 cm. of lower bowel is negative.

Clinical Diagnosis.—Obstruction of the large bowel probably due to a tumor of the region of the sigmoid flexure of the descending colon. Double inguinal hernia.

Operation.—September 2, 1916 (directly after admission).

Under local anesthesia a loop of distended bowel was brought through a small left rectus incision and a colostomy performed.

On the next day much of the tympanitis had subsided. During a spell of coughing, however, a strangulation of his right hernia occurred which was reduced with some difficulty by an intern. This hernia again became strangulated on September 5th, when it was again reduced. From this time on for two weeks the patient progressed normally. The colostomy acted satisfactorily, and the patient was able to be up and about, taking nourishment fairly well and having no abnormal symptoms. On September 20th both of his herniæ came down during an exertion, and the patient was unable to reduce them without assistance. The herniæ were reduced by an intern with only a moderate amount of difficulty and without causing the patient an undue amount of suffering. Following this the patient complained of severe pain in the right lower abdomen and his distention began to increase. On September 22d he began to vomit quantities of intestinal contents, and it was decided to make another abdominal section in order to remove the cause of the obstruction.

COMMENTS BY DR. A. J. OCHSNER

The presence of continued distention and the absence of the passage of gas or feces through the colostomy opening, and particularly the vomiting of stercoraceous material, indicate positively that the patient is again suffering from intestinal obstruction. The patient's age, and the fact that three weeks ago we operated upon him for the relief of intestinal obstruction caused by a carcinoma in the lower end of the sigmoid flexure, has clouded the symptoms during the last two days. Had it not been for these facts I am confident that we would have recognized the existence of an intestinal obstruction twenty-four or thirty-six hours earlier. This source of error was still further increased by the presence of the colostomy opening, because this made it impossible for us to determine positively that there existed an absence of the passage of gas. The presence of the intestinal distention and the nausea should have impressed us with the seriousness of the condition, but the absence of visible peristalsis, which was probably due to the age and the reduced condition of the patient, and the absence of vomiting until some hours ago served to prevent our making a proper diagnosis earlier.

In cases of suspected intestinal obstruction the most important point to be borne in mind is the caution never under any circumstances to give a cathartic. The most that could be accomplished by the use of a cathartic would be the demonstration that an intestinal obstruction does actually exist. In the meantime irreparable harm may have been done to the patient by the increased pressure within the intestines above the point of obstruction, which may result in dangerous tension or even in perforation of this portion of the intestine. In these cases, if there is any doubt, it is always best to make an exploratory abdominal section, unless the obstruction appears to be due, in all probability, to a circumscribed inflammatory process which can be determined ordinarily by a rise in temperature and pulse and by an increased leukocytosis.

In case it seems advisable to postpone an exploratory operation for a short time it is best to cocainize the pharynx by the use of a 2 per cent. cocain spray, permitting the patient to swallow some of the saliva containing the cocain, and then, after waiting five or ten minutes, to perform gastric lavage with plain water at a temperature of 105° F. This may be repeated at intervals of an hour until it is possible to perform the exploratory laparotomy. Ordinarily, however, it is best to operate immediately upon making a probable diagnosis of intestinal obstruction.

It is impossible to state in this case what may be the cause of the obstruction. Both inguinal canals are perfectly free, the herniæ having been reduced the last time about forty-eight hours ago.

Operation.—In a patient the age of the one before us, who has within a month undergone an operation for the relief of intestinal obstruction lasting nearly four days, who is not very vigorous and shows his age to the full extent, who has evidently suffered from intestinal obstruction for approximately forty-eight hours, although this obstruction may not have been complete until about six hours ago, it would seem unwise to make use of a general anesthetic, especially as we know from our experience with the same patient three weeks ago that he bears the administration of novocain splendidly.

Not being certain of the cause of the obstruction, it seems best to make an incision in the median line between the umbilicus and the symphysis pubis. We consequently inject the skin with ½ of 1 per cent. solution of novocain containing 1 : 30,000 of adrenalin. The deep tissues underlying this line are then filled with the same solution injected hypodermically. After waiting five minutes an incision is made down to the transversalis fascia, but not through it (Fig. 89). This fascia is then also injected with the same fluid, and it is then possible to continue the incision through the transversalis fascia and the peritoneum.

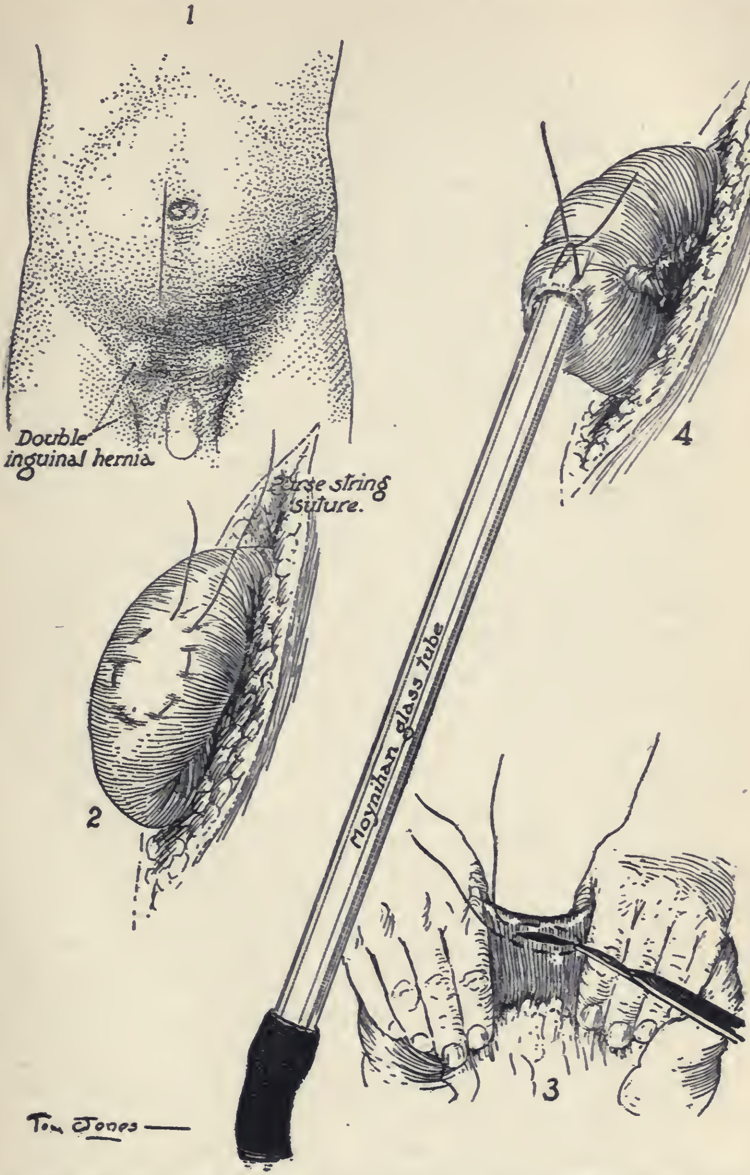

Fig. 89.—Intestinal obstruction: 1, Line of incision. 2, Proximal distended loop of bowel brought through incision. Purse-string silk suture applied. 3, Incision through the bowel. Assistant's hands prevent escape of intestinal contents. 4, Moynihan glass tube inserted and purse-string suture tied around the tube.

The small intestine is found to be enormously distended, and the necessary manipulations to determine the location of the obstruction might cause an endless amount of damage to the distended intestines. Consequently, it seems advisable to empty these of their gas and fluid contents before making any further manipulations. For this purpose we make use of the Moynihan glass tube, which is 2 cm. in diameter and 50 cm. in length, with one end inserted in a large rubber tube about 80 cm. long. A portion of the distended intestine is grasped between the fingers and thumbs of the two hands of an assistant, grasping the intestine snugly to prevent any of the contents from passing this grasp, but not tightly enough to injure the tissues of the intestine. The hands are then separated by sliding them apart, at the same time making a sufficient amount of pressure to empty completely the portion of the intestine which occupies the position between the hands. A silk suture (Fig. 89, 2) is then applied to the convex surface of the intestine in a form to include the glass tube after this has been inserted through a small longitudinal opening which is cut through the walls of the intestine within the grasp of these sutures (Fig. 89, 3). The glass tube is then inserted through this opening (Fig. 89, 4) and the suture is tied so as to prevent any leakage around the sides of the tube. The tube is directed first in an upward direction, and the entire small intestine up to the transverse mesocolon is threaded upon the tube (Fig. 90, 5). At the same time the stomach is emptied of any intestinal contents which may have been regurgitated into this organ by means of a stomach-tube and the stomach is carefully cleansed by the use of water at 105° F., which not only cleanses the stomach but at the same time stimulates the patient. The rubber tube attached to the glass tube serves as a syphon, so that the small intestine is entirely cleansed of its contents. The tube is then withdrawn from the point of insertion and directed downward, and the small intestine in this direction is threaded upon the glass tube until the point of obstruction is reached. In this manner all of the decomposing substance in the small intestine is removed, leaving the entire intestine collapsed. The bluish tinge of the intestinal wall is immediately replaced by a fine pink color. The stimulation due to the warm water used for gastric lavage is having its beneficial effect. As we proceed with the Moynihan tube in a downward direction we find that the point of obstruction is in the region of the internal abdominal ring on the right side. We find that when the slightly strangulated hernia was reduced two days ago the hernial sac was reduced with the hernia without dislodging the intestine from the grasp of the hernial sac, the neck of the sac constricting the intestine and preventing the latter from being freed from its grasp. Fortunately, the ring formed by the neck of the sac was not sufficiently tight to produce pressure necrosis of the wall of the intestine, although it was sufficiently tight to cause a complete obstruction and to prevent a proper reduction of the hernia.

In the absence of the history described above, we would undoubtedly have recognized the obstruction sooner, and had there not been several successful reductions of the herniæ under similar circumstances during the past three weeks, we would probably also have recognized the fact that the obstruction was due to a reduction *en masse* of the strangulated hernia. The fact that the hernia was so easily reducible because of the softness of the patient's tissues further served to confuse us in this direction.

Having found the cause of the obstruction, we will now remove the Moynihan tube from the intestine and carefully close the wound by means of fine interrupted silk sutures (Fig. 90, 6). The small intestine is now completely collapsed. Before removing the glass tube it is sometimes best to fill the small intestine with normal salt solution at a temperature of 105° F.: first, for the purpose of stimulating the circulation in the small intestine, and, second, for the purpose of filling the blood-vessels. In case the intestinal contents which have been removed are very offensive, it is well to fill the small intestine with normal salt solution after having removed the original fluid, and then to remove the salt solution again for the purpose of cleansing the lining of the intestine.

We have now replaced the collapsed small intestine in the

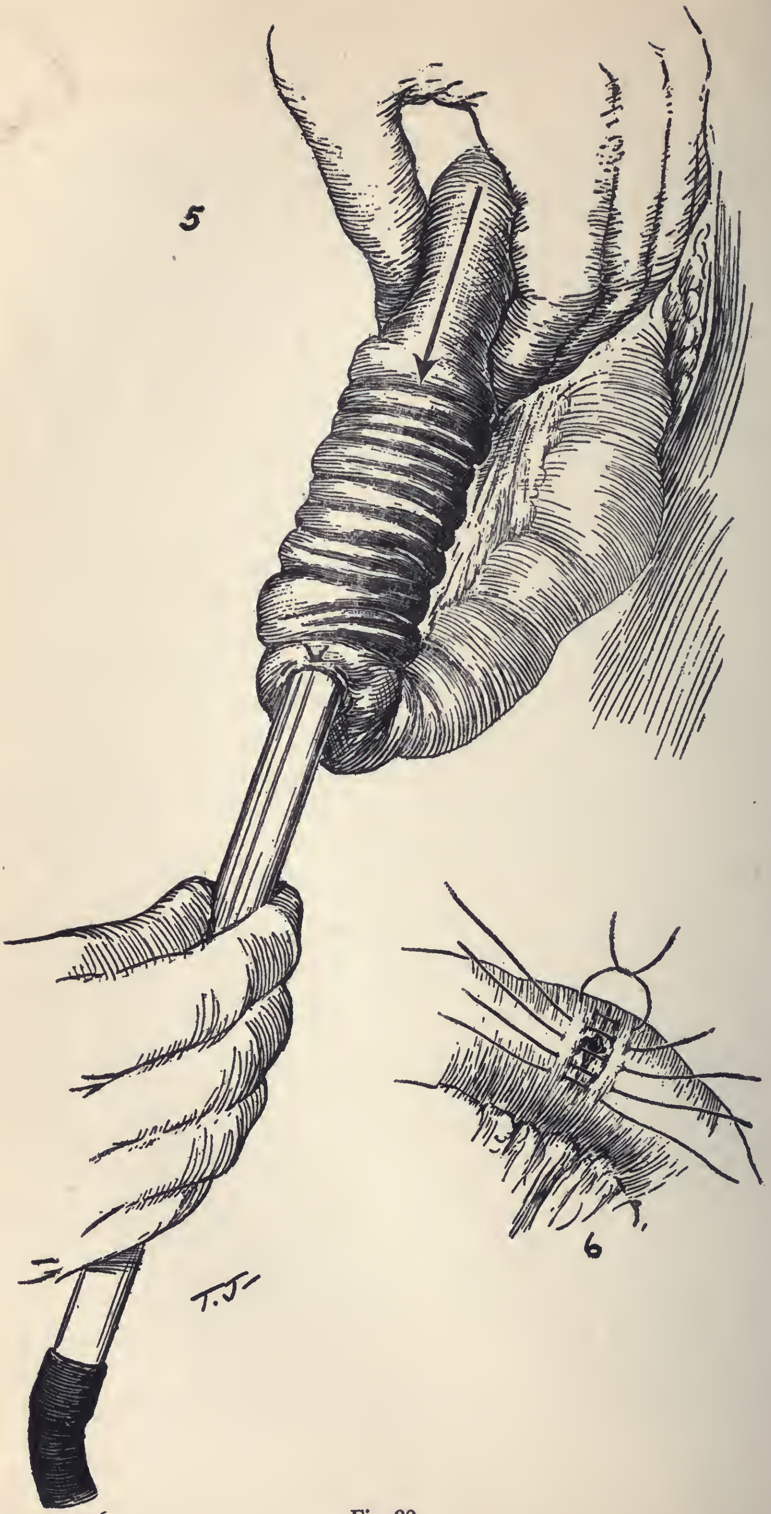

Fig. 90.

peritoneal cavity, and it is not difficult to make the necessary manipulations for finishing the operation, while, with the presence of the greatly distended small intestine, it would have been quite impossible to accomplish this without producing a very harmful traumatism.

A portion of the ileum, 8 cm. in length, is contained in the hernial sac (Fig. 91, 7). By inserting a grooved director between the intestine and the neck of the sac it is possible to cut the latter without danger of injuring the intestine, and this enables us to withdraw the intestine from the sac. The portion of the intestine which has been grasped in the sac is chocolate red in color, and there are some small adhesions to the lining of the sac which are evidently the result of a former strangulation, because they are not recent enough to have been formed during the present strangulation. While we dispose of the hernial sac we will drop the injured intestine into the peritoneal cavity, following the plan introduced by S. C. Plummer for the purpose of determining the viability of the injured intestine.

The sac having been reduced into the peritoneal cavity, we will transfix its neck with catgut and ligate it carefully and cut away the projecting portion (Fig. 91, 8). I believe that this is all that will be needed to relieve the hernia permanently, because the inguinal canal will undoubtedly close in the same manner that it would if the typical operation introduced about forty years ago by Mr. Wm. Anderson, of St. Thomas' Hospital, had been performed.

Further inspection of the piece of intestine which was contained in the hernial sac shows that the circulation has been re-established. The intestine now has a pink appearance, and there can be no doubt but what it will recover fully its normal condition. The abdominal wall is now closed in the usual manner, after placing the omentum over the intestines, which

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Fig. 90.—5, Showing method of stripping bowel over the glass tube. Many feet of intestines can be emptied in this way. After clearing the intestine in one direction the tube is withdrawn just to the incision, and then the procedure repeated in the opposite direction. 6, Method of closing opening by interrupted Lembert silk sutures applied longitudinally.

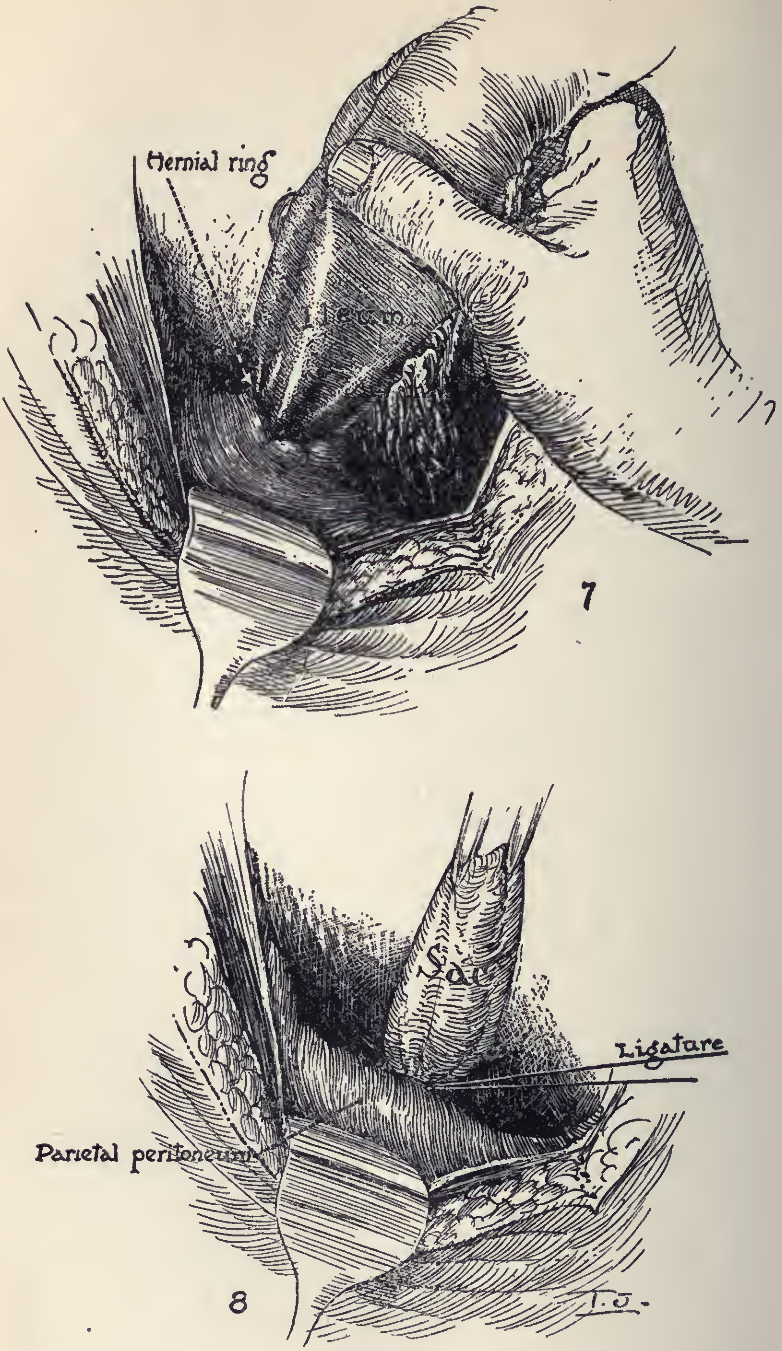

Fig. 91.

have now a normal color. An examination of the pelvis shows that the carcinoma in the lower end of the sigmoid flexure is inoperable, as it has invaded the surrounding tissues. The stomach-tube was left in place after the previous irrigation, and we will now fill the stomach with water at 105° F. in order to remove any trace of intestinal contents which may have remained after previous irrigation.

After-treatment.—We will immediately give the patient a subcutaneous transfusion of normal salt solution of 1000 c.c. If we had a donor at hand we would much prefer to give the patient 600 c.c. of blood, but, as it would be necessary to determine the compatibility of the blood of the donor with that of the patient, it will probably be better to make use of the normal salt solution. He will also be given normal salt solution together with some predigested liquid nourishment by rectum by means of the Murphy drip. We have found it advantageous in these cases to give 500 c.c. very slowly by this method, and then to interrupt this for two hours and then to repeat. In this manner the patient will absorb an enormous amount of fluid without running the risk of causing local irritation. In twenty-four hours broth and barley-gruel will be given in small quantities at intervals of two hours. At the end of six days he will be given buttermilk with cream and all kinds of strained soups. At the end of ten days he will be given cream soups. Milk will not be given for a period of two weeks. After the second day the patient will be given 2 ounces of liquid paraffin in 2 ounces of cream. Solid food will not be given for three weeks, and then only in small quantities, for fear of causing an irritation in the portion of intestine that was included in the hernial sac. In case the patient's pulse is above 120 beats per minute he will be given normal salt transfusions subcutaneously in quantities of 1000 c.c. once or twice daily.

Fig. 91.—7, The strangulated loop of ileum is in the hernial sac which has been pushed bodily, sac and contents, into the abdominal cavity. The bowel, however, is still constricted by the peritoneal hernial ring. 8, The ileum has been withdrawn, the sac inverted, and the internal ring ligated. The sac was then excised distal to the ligature, thus completing the operation.

CLINIC OF DR. N. M. PERCY

Augustana Hospital

PERNICIOUS ANEMIA; SPLENECTOMY; BLOOD TRANSFUSION

Summary: A patient presenting the characteristic history, physical signs, and blood-picture of pernicious anemia; diagnosis; differentiation from carcinoma of the intestinal tract and anemia due to intestinal parasites; pernicious anemia probably of infectious origin—basis for this belief—a rational plan of treatment: (*a*) massive step-ladder transfusions of whole blood; (*b*) splenectomy; (*c*) removal of all possible sources of infection; splenectomy—midline incision desirable; method of exposing spleen with least danger of injury to its pedicle—technic of removal; postoperative blood changes; technic of cholecystectomy in the present case—drainage through the right flank; blood transfusion; selection of donor of greatest importance—the Moss group method; technic of indirect closed method of blood transfusion—the apparatus; preparation of the veins; the rate of withdrawal of blood from the donor and the amount taken; immediate effect of transfusion on the recipient; ultimate results.

HISTORY

This patient is a man aged sixty-two, who has a good family history, except that one sister died of cancer at the age of fifty-four. He had the ordinary diseases of childhood. At the age of sixteen he had an illness lasting three weeks which was diagnosed "inflammation of the bowels." During his early life he also had frequent attacks of tonsillitis. Otherwise the patient has always enjoyed good health. There is no history of venereal disease.

Previous to the onset of his present trouble there is no history of gastric, bowel, or urinary disturbances. The present illness began about two years ago when the patient began to feel weak. He complained somewhat of sore mouth at that time and consulted a dentist about his teeth. A few cavities in his teeth were found and repaired. His sore mouth, however, remained, and a peculiar roughness of his tongue has persisted off and on ever since. The patient soon noticed that he was growing weaker and also that his pulse was gradually becoming a little more rapid. Soon after this his friends noticed that he was not looking well, saying that his color was unnatural. At that time he consulted a physician and was told he had heart trouble. The patient gradually became weaker, although at times for two or three months he would feel much better and think he was going to be well. This weakness gradually grew worse until, about four months ago, he was unable to be about, at which time he was taken to a sanitarium for treatment. A diagnosis of "pernicious anemia" was made and the patient was placed upon treatment which included medicine administered hypodermically. The general condition of the patient remained about the same; at times he was able to sit up in a chair, but was confined to bed most of the time.

About one month ago he developed pain and tenderness in the right upper quadrant of the abdomen, which was accompanied by a rise in temperature and vomiting. The patient's general condition gradually grew worse until his admission to Augustana Hospital on November 18, 1916, at which time he was bedridden and was able to take hardly any nourishment because of vomiting. He had a temperature of 100° F., a pulse of 120, and respirations 30. He was very weak and apathetic and there was a peculiar lemon-yellow tinge to the skin. The mucous membranes were very pale. He had a sore mouth and red tongue and some edema of both legs. The teeth were negative. The urinalysis was negative. Hemic murmurs were present, otherwise the chest examination was negative. There was marked tenderness and some rigidity present in the right upper quadrant of the abdomen, otherwise the abdomen was negative. The reflexes were normal and no sensory disturbances were present.

A blood examination at this time showed a count of 1,420,000 red corpuscles, a hemoglobin of 28 per cent., giving a color index of 1. The white count was 20,500, coagulation time $8\frac{1}{4}$ minutes. On counting 100 white cells there were 16 normoblasts, 12 megaloblasts, and numerous Howell bodies. A differential count revealed polymorphonuclears 53 per cent., small lymphocytes 28 per cent., large lymphocytes 15 per cent., transitionals 1 per cent., eosinophils 1 per cent., basophils 1 per cent., myelocytes 1 per cent. The blood-platelets were rare. There was also present a very marked anisocytosis and poikilocytosis. Polychromatophilia was not present.

On account of the patient's weakened condition and his inability to retain any food in the stomach a transfusion of 650 c.c. of human blood was given the day after admission and the gastro-intestinal examination delayed one week, when the patient was in much better condition. The stools were then carefully examined for intestinal parasites, but none were found. Stools were also negative as to blood.

Stomach Examination.—After the test-meal 150 c.c. of brownish-white fluid was aspirated from the stomach. No blood or bile was found, but a considerable amount of mucus was present. No food remnants in stomach at end of six hours. Total acidity 4, free hydrochloric acid 0, combined hydrochloric acid 4. No lactic or fatty acids present. Microscopic examination revealed some cocci and bacilli, but no Boas-Oppler bacilli. No red blood-cells or leukocytes found. Fluoroscopic examination and *x*-ray plates of stomach were negative.

COMMENTS BY DR. N. M. PERCY, December 26, 1916

Diagnosis.—You will note from the history that the clinical picture is quite typical of pernicious anemia with a recent attack of cholecystitis. The important points in this history are: Anemia and weakness coming on gradually without apparent cause, and gradually progressing, but with periods of remissions; persistence of sore mouth and tongue; loss of appetite; and, finally, inability to retain food in the stomach, but no special gastric distress. Sore mouth is quite a common symptom, being present in about 50 per cent. of cases. The conditions most apt to be mistaken for pernicious anemia are carcinoma of the intestinal tract and anemia due to intestinal parasites, especially the Entamœba histolytica. The latter has been eliminated in this case by the negative results of a careful search of the stools for parasites. The stomach findings here are quite typical of pernicious anemia. The total acidity is low and there is no free hydrochloric acid present. While the appetite is very poor, there is no pain, no obstruction, no blood or other findings pointing toward a carcinoma. The blood-picture is quite typical of pernicious anemia except for the leukocytosis of 20,500; in the majority of cases of pernicious anemia there is a mild leukopenia, the average count being about 4000, frequently as low as 3000, and occasionally as low as 1200 to 1500. The recent acute infection in the gall-bladder, which developed about four weeks ago, undoubtedly accounts for the leukocytosis. As soon as the inflammatory symptoms in the region of the gall-bladder subsided the white count dropped to 4000. The color index was 1. We have found the high color index to be the most constant blood finding in pernicious anemia. In addition to a color index of 1, he had an increased coagulation time, the blast cells were abundant, there was a very marked poikilocytosis and anisocytosis and a mild lymphocytosis. This blood-picture, together with the other clinical findings, especially with a history of periods of remissions, is sufficient to make a diagnosis of pernicious anemia.

Etiology.—As to the etiology of pernicious anemia, there is very little known; in fact, the whole subject of anemia is rather obscure. There still seems to be some difficulty in even establishing a rational plan of classification of anemias in general. This is probably due to our meager knowledge of the hematopoietic organs. Pernicious anemia is an artificial, arbitrary term, meaning simply the final degree of viciousness in anemia. Whatever the cause of pernicious anemia may be, it seems quite clear that it must be classed as a hemolytic anemia; that is, one in which there is an increased destruction of blood rather than a lack of production of blood. The fact that removal of the spleen brings about a marked reduction in blood destruction indicates that the increased blood destruction is in some way associated with an abnormal functioning of the spleen. Various observers, in studying blood destruction in pernicious anemia before and after splenectomy, have found that greatly increased hemolysis present before operation showed a constant and marked decrease afterward, yet the manner in which the increased hemolysis takes place is an unsettled question. While the factor maintaining the normal balance between the production and destruction of blood is unknown, most observers agree that the spleen is the organ primarily responsible for the destruction of the worn-out blood-cells.

The spleen is the largest of the ductless glands, but there is very little definitely known concerning its function. It is evident, however, that the spleen does not have an important internal secretion, because of the fact that its removal does not deprive the body of any important constituent and does not jeopardize the life or comfort of the individual subsequently. There are numerous reports where on account of injuries to the spleen it was deemed necessary to remove it, and after the lapse of many years the patient had apparently suffered no ill effects therefrom. Notwithstanding the fact that there has been an immense amount of research work done regarding the physiology and function of the spleen a great deal of confusion still exists. There has really been very little determined that might guide us in the treatment of diseases apparently due to an abnormal functioning of the spleen. We still must depend upon clinical observations to guide us in determining the course of treatment in these cases.

While the etiology of pernicious anemia is unknown, it seems evident that there is a condition of increased hemolysis together with some action on the bone-marrow. From our study of these cases we have been impressed with the observations of Hunter as to the toxic or even infectious nature of the disease. The question is, What is the source and nature of the infection? Early in our work, when studying 2 cases of pernicious anemia, we noted that the symptoms of a chronic cholecystitis were a prominent feature in the history and had existed for a considerable time previous to the onset of the anemic symptoms. The existence of an infected gall-bladder was demonstrated later at the time of operation. Since this time every case has been studied for the existence of a chronic infection, and in practically every case one or more foci of infection were found. Just what effect the presence of a low-grade infection may have upon the hemolytic organs is still unknown. The regions in which foci were found were the gall-bladder, appendix, teeth, and throat. In 38 cases of pernicious anemia which have come to operation during the past three years cholecystitis with or without stones was found in 30 cases, 26 of which also showed evidence of infection in the appendix; 6 cases showed marked evidence of infection in the appendix; 7 cases had marked infection about the teeth, and 2 cases had infected tonsils. The spleens removed have shown evidence of a chronic splenitis and usually perisplenitis, indicating that a toxic or infective process had been present there.

Early in our work the diagnosis of these infections was made from the macroscopic pathologic findings at time of operation. From the last 9 cases of pernicious anemia operated all the specimens removed were sent to the laboratory for bacteriologic study, with the following results: Bacteria were grown from three of the nine spleens removed, from four of the seven gall-bladders removed, and from six of the seven appendices removed. The only case not giving a growth was the one in which the spleen was the only organ removed, the appendix having been previously removed. This patient had a longstanding pyorrhea, for relief of which several teeth were extracted. The predominating micro-organism found was the hemolytic streptococcus, being present in 7 of the 9 cases. The colon bacillus was present in 5, the Streptococcus viridens in 4, the Staphylococcus albus in 1. While it is impossible to state anything definite as to the relation of these various infections and pernicious anemia, still it is an interesting observation both from the standpoint of etiology and treatment.

Now as to treatment:

Believing that pernicious anemia is, in all probability, a disease of infectious origin, and that the spleen has an abnormal hemolytic action on the blood elements with a late bone-marrow exhaustion, it would seem that the rational treatment should consist of three main factors—viz.: (*a*) Massive step-ladder transfusions of whole blood; (*b*) splenectomy, and (*c*) removal of all possible sources of infection.

Each of these steps is important. The blood transfusions nourish and stimulate the bone-marrow to action and help to restore the secondary changes in the various organs; the splenectomy reduces the amount of blood destruction, and the removal of the foci of infection relieves the patient of a source of chronic toxemia and possibly of an etiologic factor of the disease.

I have here the blood chart of this case, showing the changes in the blood condition since his admission to the hospital five weeks ago. He was given a transfusion of 650 c.c. of blood on November 21st, and by November 24th his red blood count has increased from 1,420,000 to 2,900,000, the white count having decreased from 20,500 to 14,000. By the 27th the red count decreased to 2,500,000 and the white count to 4000. During this week the patient was given only small amounts of liquid food and hot moist dressings were applied over the gall-bladder region. The pain, tenderness, and rigidity in right upper quadrant of abdomen had practically all disappeared by the end of his first week in hospital. A second transfusion of 600 c.c. of blood was given on November 28th. The diet was increased and 10 drops of tincture of nux vomica was given before meals and 20 drops of dilute hydrochloric acid after meals. On December 5th his red count was 3,040,000, white count 4100, and his general condition was very much improved. A third transfusion was given on December 7th and a fourth on December 23d. Yesterday, December 25th, his red count was 4,010,000, hemoglobin 73 per cent.; white count 6400, polymorphonuclears 69 per cent., small lymphocytes 20 per cent., large lymphocytes 7 per cent., transitionals 2 per cent., myelocytes 2 per cent. The entire blood-picture has changed; very few nucleated cells are present and the red cells are much more regular in outline and more uniform in size. During these past four weeks the patient has taken three good meals daily, which, together with the four blood transfusions, have changed the entire clinical picture. This patient is now a good surgical risk, while at the time of admission to the hospital he was a very bad surgical risk.

The operative procedure in this case will consist in removing the spleen, gall-bladder, and probably the appendix. This will be followed by a transfusion of 600 to 800 c.c. of whole blood.

Operation (December 26, 1916).—In doing a splenectomy in a case of pernicious anemia we elect a high midline incision instead of the ordinary left rectus incision. We elect this incision for three reasons: First, so that we can explore the rest of the abdominal cavity, namely, the region of the gall-bladder, stomach, and appendix. Second, this incision can extend higher than any other incision, namely, to the ensiform cartilage. Third, it is easier to reach the spleen through a midline incision when the pedicle is short, because the blood-supply of the spleen runs from right to left, and as we dislocate the spleen and roll it upward we are pulling it toward its blood-supply and we run less danger of tearing its pedicle in bringing it up.

Now we will make our incision from the ensiform cartilage to the umbilicus in the midline. I am making the incision in the linea alba to have as little hemorrhage as possible, and we now split the linea alba. Now we come down and pick up and open the peritoneum. We will place forceps on all the subcutaneous bleeding points so as not to lose any more blood than is necessary.

Now that the abdomen is open, we will make an exploration of the abdominal cavity. First, coming down in the region of the gall-bladder we find the omentum adherent to the gall-bladder, and as we get down further we find rather a tense gall-bladder which is not compressible. Its walls feel very thick and edematous. As we explore further we find numerous enlarged lymphatic glands along the cystic and common ducts, but apparently no stone. We will now explore the appendix region. The appendix is found adherent back of the cecum and kinked, the distal end is cicatricial, and there is a strong adhesion about 1 cm. from the cecal end, making a distinct kink in the appendix. We will now loosen the appendix and remove it. You see how easy it is to bring the appendix up into this midline incision, which extends no further than the umbilicus. Now we will explore the spleen. We have just explored the pelvis and the colon, both of which are negative. On exploring the splenic area we find the omentum adherent to the lower end of the spleen and to the anterior abdominal wall. The upper portion of the spleen is not abnormally adherent.

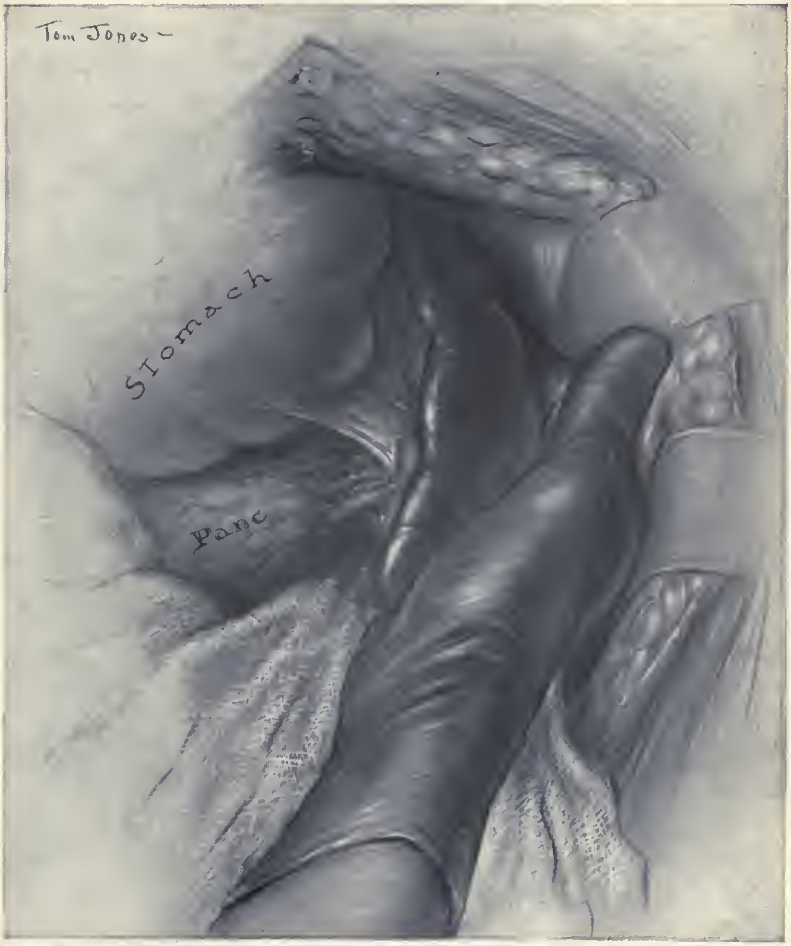

Fig. 92.—Through a midline incision, well retracted to the left, the spleen is brought forward with the hand. Note the proximity of the stomach and pancreas. Omentum and intestines packed away with gauze.

We will now place one large abdominal pad in the left upper quadrant of the abdomen to keep the omentum, colon, and small intestine away from the field of operation. Now the omentum is carefully loosened from where it is adherent to the spleen. I now pass my hand around the outer and upper edge of the spleen

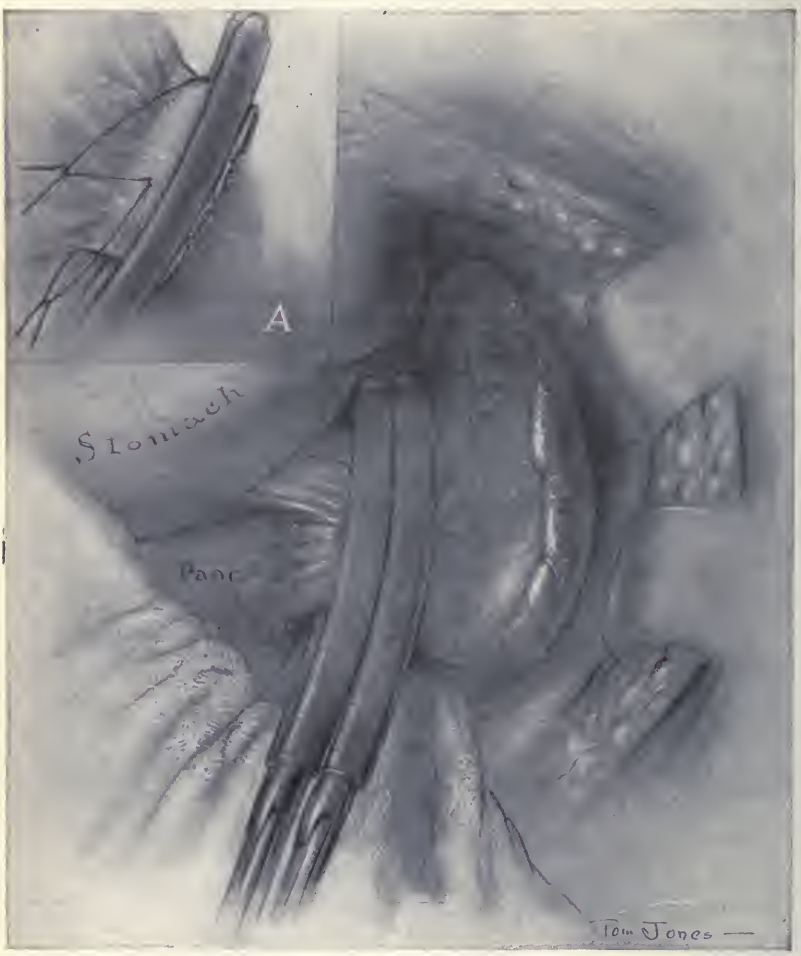

Fig. 93.—Removing the spleen. Two rubber-covered clamps applied to the pedicle. Insert *A* shows method of ligating with two ligatures after the proximal clamp has been removed.

and loosen it from its location against the diaphragm and from in front of the left kidney (Fig. 92). Now as the spleen is loosened you see it is rolled forward to the midline. In doing this it is rolled toward the base of its pedicle and not away from it. By passing the thumb and finger around the pedicle of the spleen we depress the stomach, and then we grasp the pedicle with two rubber-covered clamps, being careful to protect the tail of the pancreas and also the stomach, as these spleens are usually in very close apposition to the stomach at their upper borders (Fig. 93). In this case we can grasp the entire pedicle with one forceps, though frequently it is necessary to grasp the splenic omentum above and below the pedicle separately. It is always easy to tie the gastrosplenic omentum at its lower pole, but it is often difficult above because of the vasa brevia which are present in the gastrocolic omentum at the upper portion, as they run from the splenic artery to the stomach. Now that we have grasped the pedicle of the spleen in these two forceps, and have been careful not to injure the stomach in so doing, we will cut off the spleen pedicle and let the contained blood go into the abdomen, as there is no space to place another forceps on the pedicle. With the extremely short pedicle of this spleen you see how much easier it is for me to pull the spleen up through this midline incision than through a left rectus incision. We will now ligate the pedicle of the spleen *en masse* by first transfixing with heavy catgut and tying, using two ligatures.

You will notice that the assistant is making a blood count while I am tying the pedicle of the spleen. An immediate leukocytosis takes place following splenectomy. We have recently made the observation that this leukocytosis is primarily a lymphocytic leukocytosis, while formerly we always supposed it was a polymorphonuclear leukocytosis. This lymphocytic leukocytosis, however, gives way to a polymorphonuclear leukocytosis within twenty-four hours. This patient's white count, which at the beginning of the operation was 4400, is undoubtedly by this time 12,000, and by this evening or tomorrow will be 20,000 or 25,000.

You see we have now ligated the pedicle of the spleen *en masse.* You notice we have not lost a single drop of blood from the pedicle of the spleen. We will now make a suture in the pedicle of the spleen to make sure that our ligature will not slip

(Fig. 94). Now, by putting a couple of little sutures in when the pedicle is ligated it makes it impossible for the pedicle ligature to slip. Now we will see if any of the adhesions at the lower part of the spleen and in the region of the pancreas are bleeding, and if so, the areas will be sutured. Right in front of the spleen

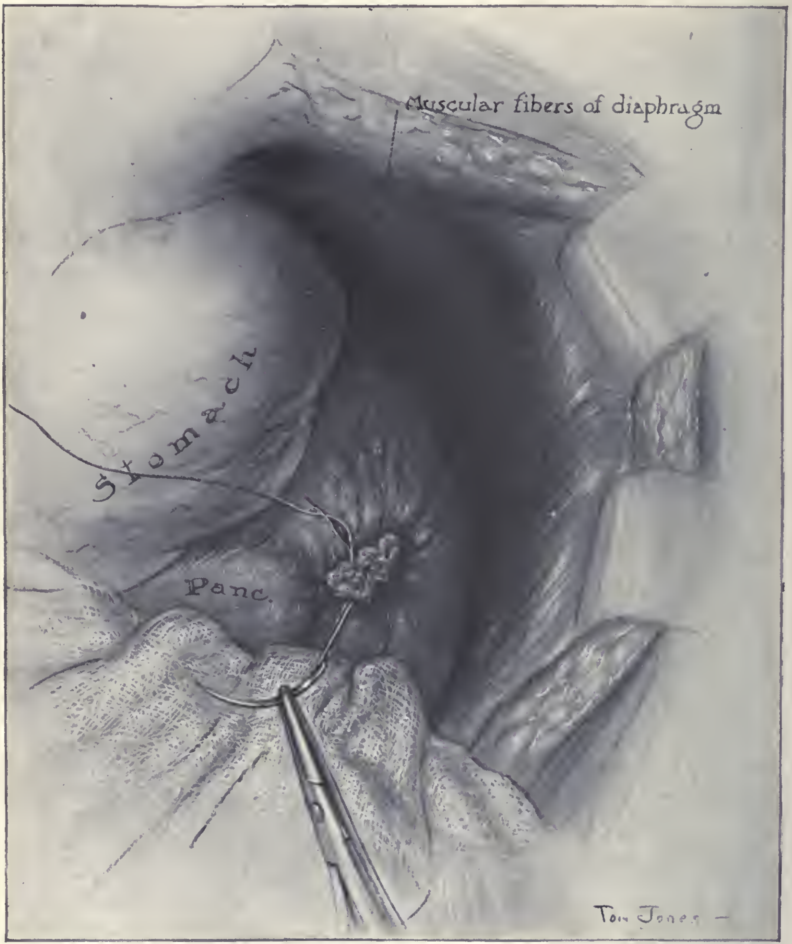

Fig. 94.—Stump of ligated pedicle. Two or three sutures passed through the stump to insure against slipping of the ligatures. These sutures are tied and the colon and intestines allowed to replace the splenic space. The abdominal wound is then closed without drainage.

you will see one little vein oozing. We will suture this with fine catgut. There is the tail of the pancreas. We will now sponge out the space from which the spleen was removed, which, of course, contains the blood which was in the spleen at the time its pedicle was cut. In sponging out the splenic area you will notice that it is absolutely dry. That is the blood that was in the spleen. There was not 1 dram of blood lost from the splenectomy. Now we allow the pedicle of the spleen and the splenic flexure of the colon to drop back into its normal position.

Cholecystectomy.—Coming over into the region of the gall-bladder again, we find an edematous and distended gall-bladder with the omentum still adherent to it. You will note that from our midline incision it is also very easy to get at the region of the gall-bladder. We will now clamp the omentum, which is strongly adherent to the fundus of the gall-bladder, between two pairs of forceps and ligate it. We separate the adhesions down to the site of the gall-bladder. We again examine the common duct and find no stone. There is an enormously enlarged lymphatic gland. We find rather a strong adhesion between the pylorus and the neck of the gall-bladder. We will remove this infected gall-bladder by first dissecting free its cystic duct. We have now separated the cystic duct, and it is clamped by two pairs of forceps and cut. Holding the cystic duct and neck of the gall-bladder forward, the cystic artery is secured and then the gall-bladder is removed. All the specimens removed are placed in a sterile basin and cultures will be made. Contrary to our usual custom, we will leave the cystic duct open instead of ligating it because of the acute inflammatory trouble in the gall-bladder. We place a ligature on the cystic artery and then place two or three sutures on the under surface of the liver, bringing together the two peritoneal edges of the space from which the gall-bladder has been removed. We place one more suture here in the liver at the former site of the gall-bladder. We are going to place our drainage from the gall-bladder in a stab-wound over in the right ileocostal space so as to keep our drainage away from the pylorus and the duodenum. That will do away with the possibility of getting adhesions between the liver and duodenum, the stomach, and the anterior abdominal wall. I simply cut through the skin and then pass the forceps through and stretch the muscle. Then the drain is drawn down underneath the liver. Our drain is placed transversely from the cystic duct, right across underneath the edge of the liver through the stab wound, and then the hepatic flexure of the colon is laid back up against the drain in its normal location.

In looking over the space from which we removed the spleen I find that area perfectly dry. We will now close the abdominal incision in the usual manner. You will notice that the patient looks well, but his pulse is rapid, being 120 per minute.

Now we will give him a blood transfusion, which will undoubtedly bring the pulse down under 90 before he leaves the operating room.

BLOOD TRANSFUSION

The most important part of a blood transfusion is the selection of a proper donor. The donor should not only be a person whose blood is compatible with that of the patient, but he should be free from any infectious disease. It is not justifiable to make a blood transfusion without first determining the compatibility of the two bloods by hemolytic or agglutination tests. This applies to near relatives as well as to aliens.

During the past thirteen months we have been using the group method of Moss in selecting donors. This method is based on the theory that before hemolysis takes place between two bloods there is always previously or simultaneously an agglutination of the corpulsces of one blood by the serum of the other. The reverse, however, is not necessarily true, occurring in only about 20 per cent. of cases. Moss has found that all individuals can be classed into four groups according to the agglutinative properties of their blood. In selecting a donor, we like to have the patient and donor belong to the same group. The technic of grouping the blood after the Moss method is very thoroughly described by Brem in the Journal of the American Medical Association, July 15, 1916.

This patient belongs to group II. His wife and two daughters also belong to group II. We will use the wife as the donor today.

The method of transfusion which we will use is an indirect closed method. We call it a closed method because the blood does not come in contact with the air. The apparatus consists of a large glass tube of 900-c.c. capacity, one end of which is drawn out into a canula to be inserted directly into the vein, the other end drawn out to a tube about 1 cm. in diameter, with which a Y connection is made. The Y connection has a two-way valve (Fig. 95). To one arm of the Y a rubber tube and glass mouthpiece are attached so that suction can be made during the filling of the tube. To the other arm a rubber atomizer bulb is attached to aid in emptying the tube. The tube is coated inside with solid grocer's paraffin, and just before the transfusion is begun about 1 ounce of sterile liquid paraffin is aspirated into the tube. The liquid paraffin will remain at the top of the column of blood and thus prevent the blood from coming in contact with the air.

An ordinary blood-pressure cuff will now be placed around the arm of the donor as high as possible. If one wishes to draw off blood rapidly from an arm there must be just enough constriction of the arm to obstruct the venous circulation, but not enough to interfere at all with the arterial circulation. The amount of pressure can be regulated accurately by the use of the blood-pressure apparatus. The cuff is now inflated until the gage registers 50, and it is kept at this pressure, as we have found this to be the proper pressure for the average individual. You can see how plain the cephalic vein shows now. We will anesthetize the skin by injecting 0.5 per cent. novocain solution. I have now exposed the cephalic vein for a distance of ½ inch. A ligature is placed around the proximal portion of the vein and a small clamp on the distal portion. A small slit will now be made in the wall of the vein and a special forceps placed on each side of the opening in the vein to keep it open, making it easy to introduce the canula of the tube into the vein. A vein on the front of the forearm of the patient is now exposed and prepared in the same manner, except that it is ligated distally and the little clamp placed proximal to the opening in the vein. We always make an open dissection of the veins so as to avoid hav-

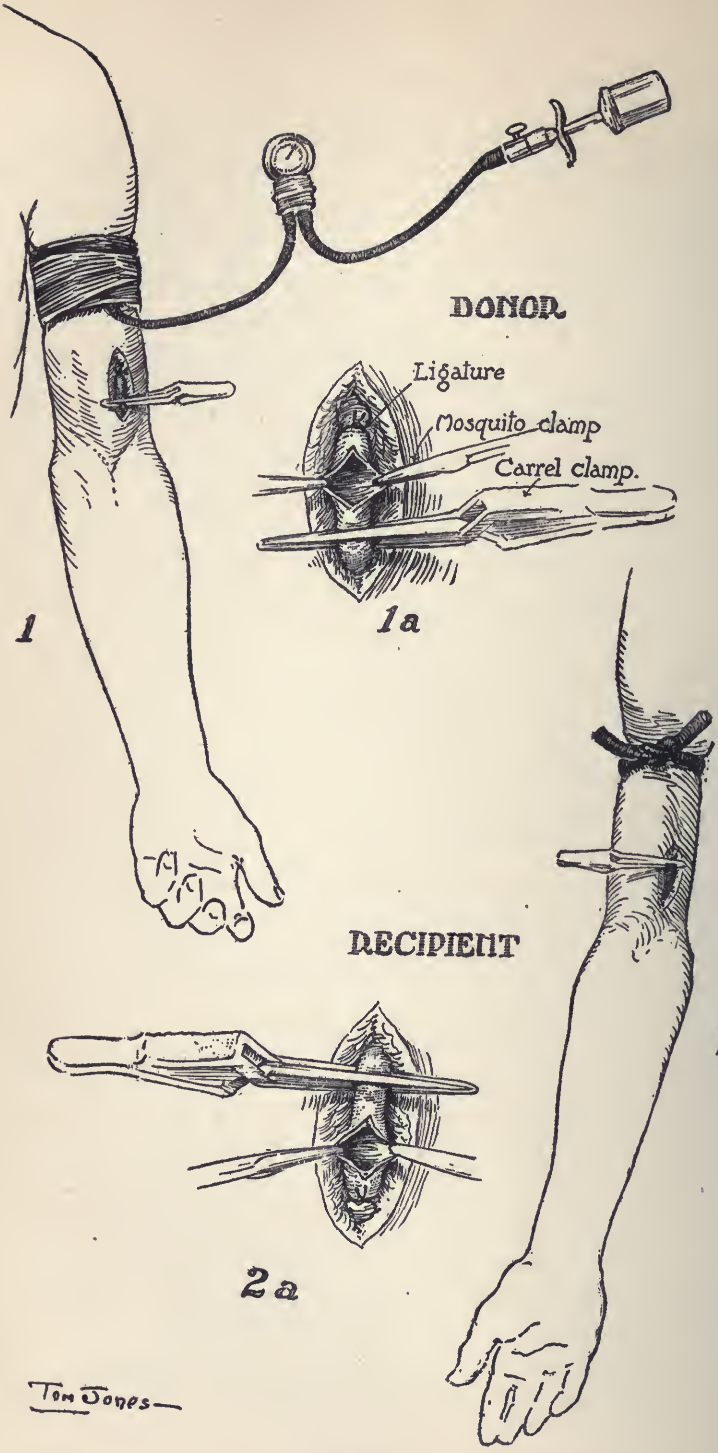
DONOR
Ligature
Mosquito clamp
Carrel clamp.
1
1a
RECIPIENT
2
2a
Tom Jones

Fig. 95.

ing to make any connections to a needle, which would make a rough area, thus favoring the formation of a clot. Furthermore, in chronic anemic cases the superficial veins are so small that it is necessary in 80 per cent. of instances to make an open dissection of the vein.

The veins of both donor and recipient have been prepared. We now insert the canula of this tube distally into the donor's vein and remove the little clamp from the vein. The assistant now makes gentle suction on one arm of the Y connection of the tube, thus aiding in filling the tube (Fig. 96, 3). You can see the layer of liquid paraffin remaining on top of the column of blood, keeping the blood from the air. You will notice that the tube is filling at the rate of 200 c.c. per minute, which is our average flow from a male donor. It has taken just three minutes to obtain the 650 c.c. of blood. The assistant now closes the Y valve, thus creating a vacuum in the tube, which will prevent the blood from escaping from the tube while it is being transferred to the recipient's vein.

We now insert the canula of the tube into the vein of the recipient (Fig. 96, 4). The blood is now flowing into the recipient; the rapidity of flow is controlled by the amount of pressure made by compressing the atomizer bulb. It has taken a little over two minutes to empty the tube.

The veins of both donor and recipient are ligated and the wound closed with horsehair. You will note that it was not more than ten seconds from the time the canula was removed from the donor's vein until it had been inserted into the recipient's vein. The patient received 650 c.c. of whole blood which did not come in contact with the air; in fact, the blood did not touch anything except the smooth paraffin, not even glass.

Comments.—The immediate effects from a blood transfusion are usually quite striking, especially as to relieving the symptoms of shock. A few minutes ago this patient's pulse was 120 per minute, and now, within ten minutes after receiving 650 c.c. of

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Fig. 95.—1, 2, Preparation of the arms of donor and recipient for blood transfusion. 1*a*, 2*a*, Dissection of the veins of donor and recipient shown in detail.

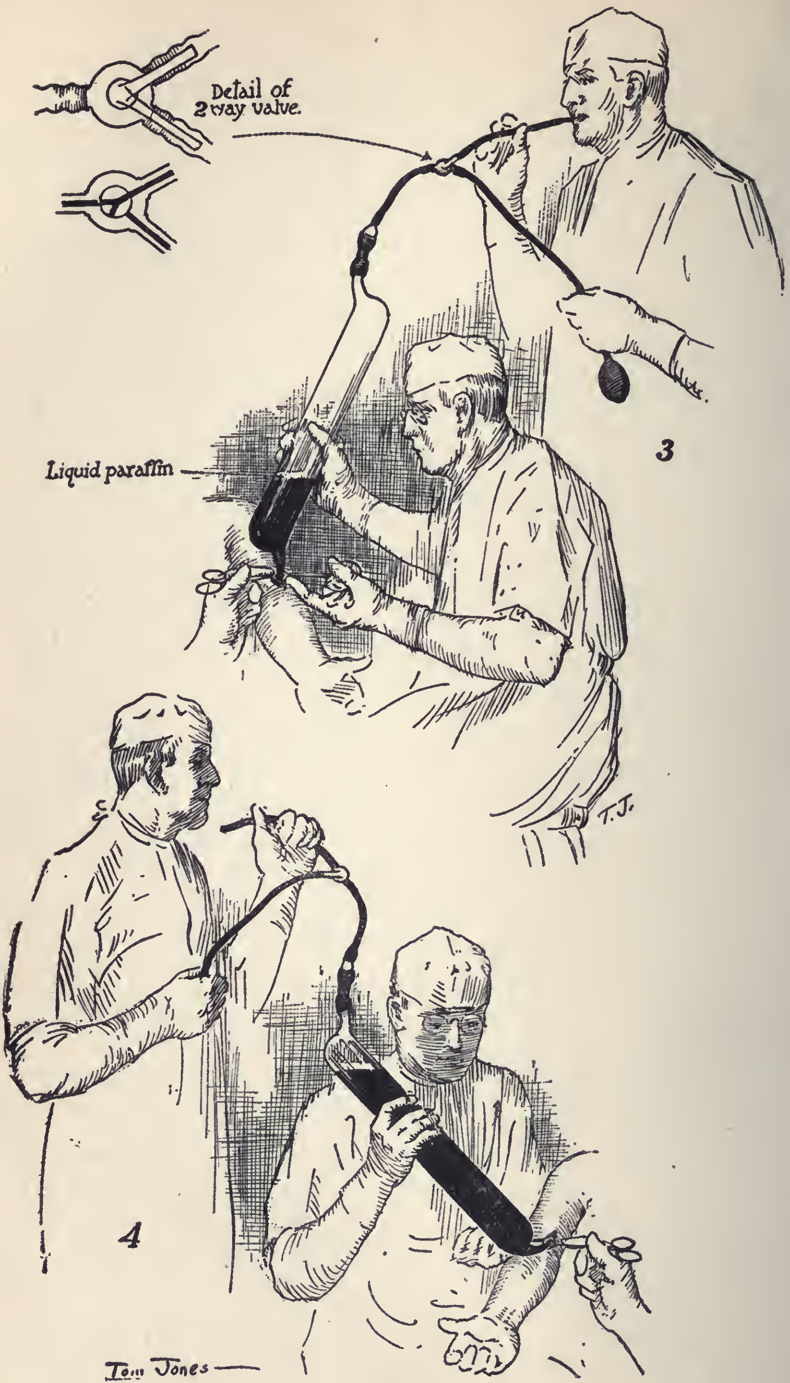

Fig. 96.

blood, his pulse is 94 and of very good quality. You see his color is good, and I am sure that by the time he is taken down to his bed the pulse will be under 90. On several occasions, in patients showing symptoms of shock at the close of a severe operation with a pulse of 140 or more, by means of a blood transfusion the pulse has been reduced to under 90 within a few minutes and remained under 100 throughout their convalescence.

As to the ultimate results of pernicious anemia treated in this manner time only will tell. It is too early for any surgeon to say that he has really cured a case of pernicious anemia in the manner described above. Our oldest case had her splenectomy and last blood transfusion in March, 1914, and this patient now, at the end of thirty-four months, is in good condition and has had no recurrence of symptoms. The interval since operation in the others varies from twenty months to the present time. Recently I have looked up all the cases operated prior to June 1, 1916, there being 24 in number, and found that 58 per cent. of these were still in good condition, the interval since operation varying from nine to twenty months. The majority of these were extremely late, long, bedridden cases. Even though no ultimate cures may result, from our experience it would seem that the work is worth while, and that the treatment outlined above offers, at least, the most sure and most rapid method of obtaining a remission of the disease.

Note.—This patient made an uninterrupted, immediate recovery, was up walking about at the end of seventeen days, and left the hospital thirty-two days after operation, feeling very well and with the following blood-picture: Erythrocytes, 3,900,000; leukocytes, 16,600; hemoglobin, 80 per cent.; color index, 1; coagulation time, four minutes. In counting 100 white cells one

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Fig. 96.—3, Method of obtaining blood from donor. Note layer of liquid paraffin floating on the blood. Insert shows detail of the two-way valve. The operator and his assistant hold the vein over the canula by means of traction on the mosquito clamps. Gentle suction is made by a second assistant. 4, The canula of the transfusion tube inserted in the vein of the recipient. The edges of the vein are held in the same way. Gentle air pressure is applied above the blood chamber by means of a rubber atomizer bulb.

megaloblast was seen, but no normoblasts. No polychromatophilia present. The red cells were quite uniform in size, but a few were slightly irregular in outline. Polymorphonuclears, 64 per cent.; small lymphocytes, 28 per cent.; large lymphocytes, 7 per cent.; transitionals, 1 per cent.

CLINIC OF DR. JOHN RIDLON

PRESBYTERIAN HOSPITAL

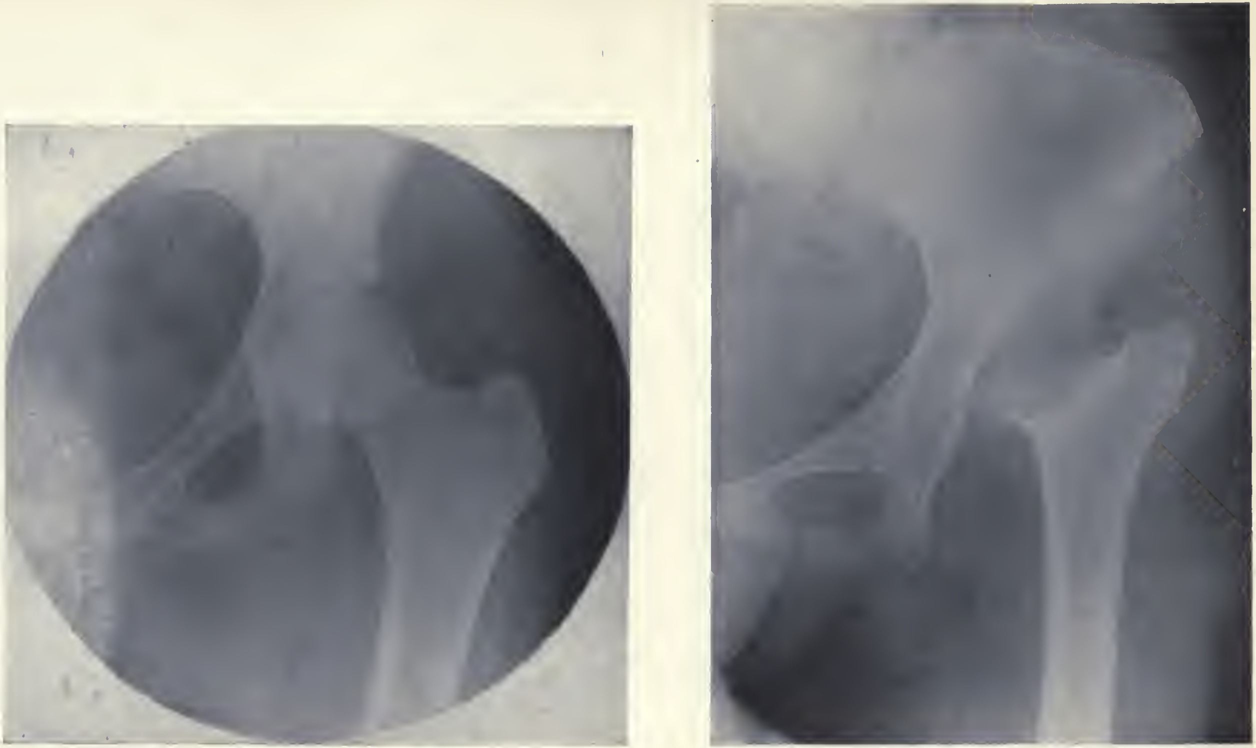
CONGENITAL DISLOCATION OF THE HIP

Summary: Time to replace the hip is determined not by the age of the child, primarily, but by the degree of shortening and the muscular development—causes of restricted motion following operation; technic of the "Lorenz operation"—its limitations; the Ridlon operation—the permanent dressing and after-treatment; hip cases divided into three classes when considering prognosis—results least satisfactory in bilateral cases; how to manage recurrence in bilateral cases; failure of cutting operation—functional results when anterior transposition is the best obtainable anatomic result—treatment after removal of cast.

October 30, 1916.

We have today three patients with congenital dislocations of the hip. They illustrate several phases of the condition. The first is a girl four years old with 1½ inches upward dislocation of the right hip. She began to walk when she was sixteen months old and has had no treatment. Most cases of congenital dislocation of the hip are in girls. I do not know why. In most cases of unilateral dislocation it is the left hip that is affected. Why I do not know. In this case it is the right. The amount of shortening when the child has walked only a short time is about ¾ inch. By the end of the second year the shortening reaches about 1 inch. By three and one-half years, the choice age for operating, the shortening has become from 1¼ to 1½ inches. Much has been said about the proper age for operating and the age limits. Really the age has very little to do with the right time to operate. It is the extent of the shortening that is of real importance. To replace a hip when the shortening is only ¾ to 1 inch is usually as unwise as it is easy to do. Such a case when replaced almost invariably slips out again because the structural shortening of the muscles is not enough to hold the replaced hip securely in its socket. On the other hand, one must not wait for too great shortening; $1\frac{3}{4}$ inches shortening in a well-muscled child eight or nine years old is difficult to replace, although 2 inches may not be difficult in a child of three or four years of age. At any age where the shortening amounts to about 2 inches, if the replacement is difficult, the hip is often left with more or less restricted motion for a year or two. The restriction to motion after replacement in very difficult cases appears to be due to two causes: First, the lack of required length in all the muscles controlling motion at the hip-joint; second, to the severe intra-articular pressure caused by the short muscles. Here are two radiograms illustrating such a result (Figs. 97 and 98). When this girl was seven years old Lorenz attempted to replace the dislocated hip—and failed. I immediately replaced the hip. This radiogram was taken on the removal of the cast eight months after the operation (Fig. 97). It shows the femoral head in the socket and the usual form and angle of the neck in its relation to the shaft. A radiogram made twelve years later (Fig. 98) shows the head depressed to the position of coxa vara. The young woman had a normal range of motion, walked without limping, and believed the result of the operation to be perfect. She did not know that the limb was an inch short. Most cases where the muscular shortening is great have a flattening of the head of the femur and some pressure changes in the upper part of the acetabulum that with the shortened muscles cuts off about half of the normal range of motion.

The bloodless replacement of these congenitally dislocated hips is usually called the "Lorenz operation." The operation which I shall show you is not the Lorenz operation. Lorenz thought he stretched the capsule of the joint by extreme movements of the limb in all directions and then stretched the limb itself downward by having two or three men pull on it while the pelvis was held fast by a sheet passed between the legs and tied to the head of the table. After stretching to his satisfaction he flexed the thigh to a right angle and from that position abducted it until the adductor muscles stood out prominently. These he tore across subcutaneously by hacking at them with the edge of



Figs. 97, 98.—Illustrating changes sometimes produced in congenitally dislocated hips after reduction by the severe intra-articular pressure due to unusually short muscles.

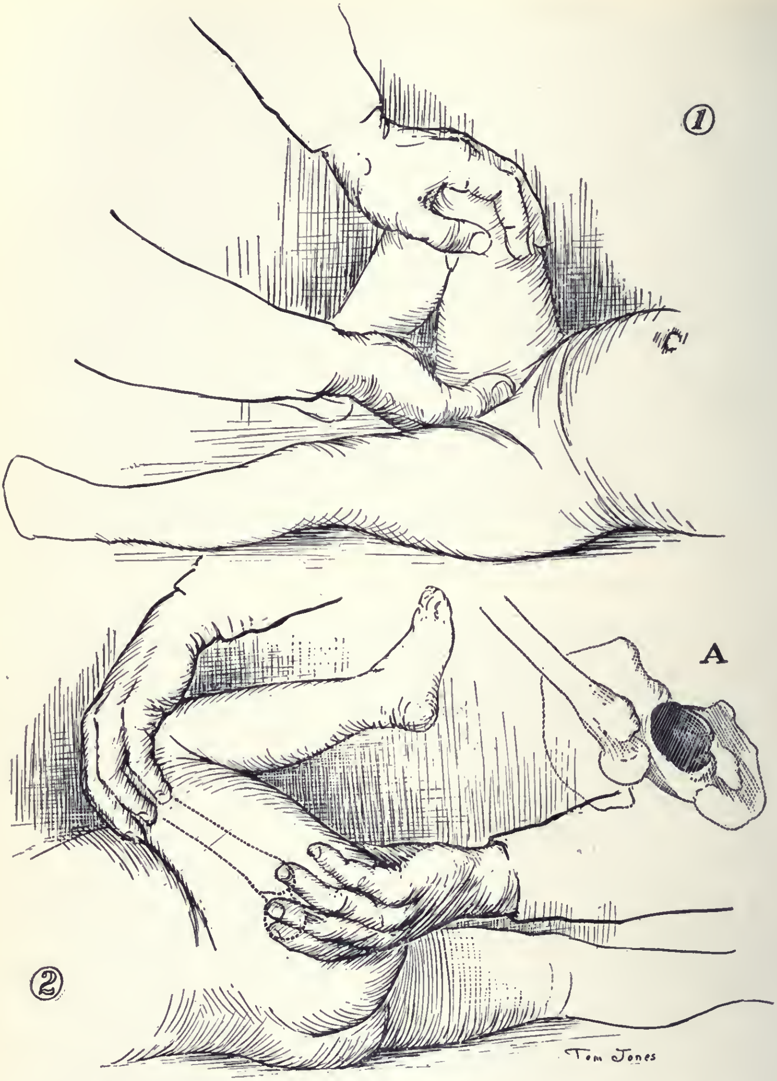


Fig. 99.—1, The thigh flexed to right angles by the left hand when the operation is on the right leg. The thumb of the right hand shows in front of the socket. 2, Posterior (and somewhat inferior) view showing the thigh fully flexed by the left hand on the patient's knee and the first three fingers of the right hand on the head, neck, and greater trochanter of the dislocated hip. Insert *A* shows the bone relations at this point. The head is passing down from above the socket.

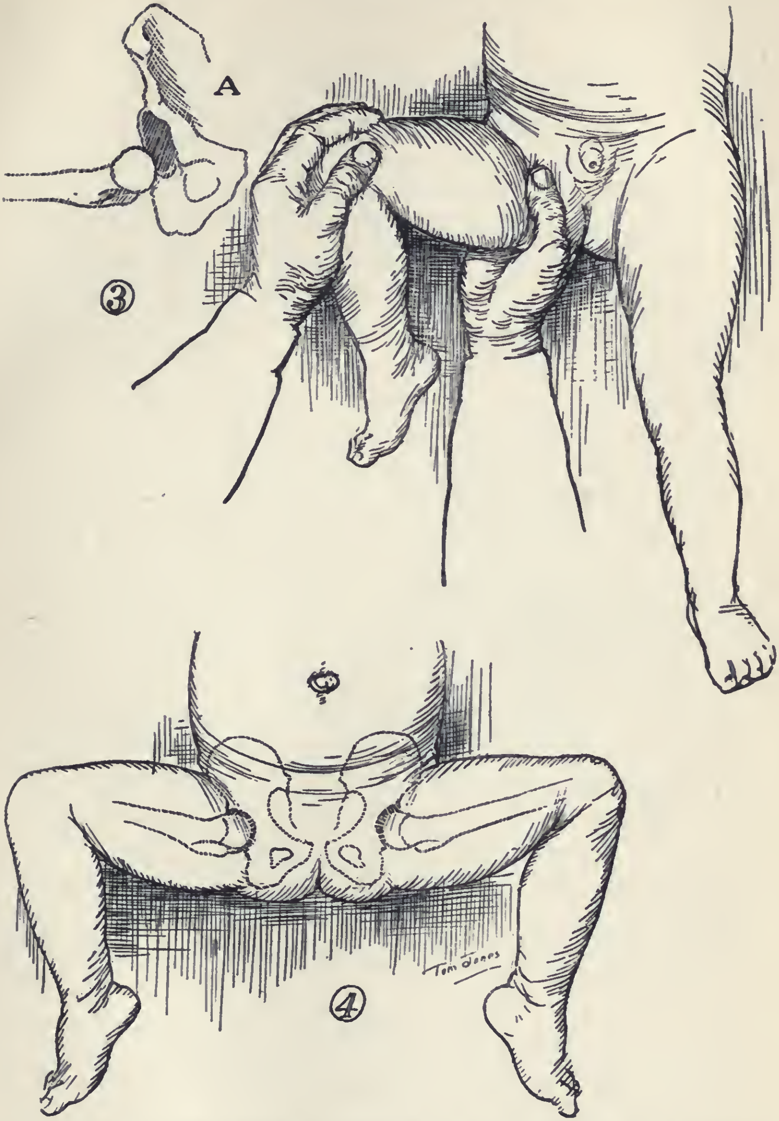


Fig. 100.—3, The position of abduction as the head passes into the socket. The head can be felt now rising up in front by the thumb of the right hand. Insert *A* shows bony relations. The head rising up into the socket. 4, The frog position in a bilateral case after both hips have been replaced. Relations of femur and hip shown diagrammatically.

his hand. Then he further abducted the thigh from the position of right-angled flexion, prying it over the edge of König's wedge-block under the buttock until the femoral head passed over the back of the rim of the socket into it, or until the femur broke (usually at the neck), or he gave up, calling it an impossible case. During the two years following Lorenz's visit here I broke five femoral necks while attempting his operation. Then I changed my method to the one which I shall show you, the one which is known among orthopedic surgeons as the Ridlon operation. This is the operation I have been doing since 1904. It is much the same operation as was described in the December, 1915, number of the Murphy Clinics.

Without any preliminary stretching or treatment of any kind whatever the patient's flexed right knee (if this is the dislocated hip) is grasped in the operator's left hand and the thigh fully flexed on the body. Then the operator finds the greater trochanter, neck, and head of the femur with the fingers of his right hand and places the thumb of that hand in front, below the anterosuperior spine of the ileum, in front of the socket (Fig. 99, 1, 2). For the left hip the position is reversed. Thus he can judge accurately the relation of the femoral head to the socket. When the thigh is fully flexed, the femoral head is usually opposite the lower part of the socket. Sometimes it is too low and the flexion of the thigh must be lessened. At other times it is not low enough, but can be brought low enough by rotating the thigh inward. This turns the foot and the leg outward: When the head is finally in the right position opposite the lower part of the rim of the socket, the operator abducts the thigh with the left hand which is grasping the flexed knee, the opposite side of the pelvis being meanwhile held firmly down by an assistant, and the head can be felt by the operator's fingers and thumbs passing forward and into the socket (Fig. 100, 3, 4). In cases that have a fairly good socket the operator can let go of the limb after it has been replaced and the hip will stay in place. In cases with poor sockets the hip will slip out as soon as he lets go of the limb. In such a case the hip should be replaced again and again, and further stretched and twisted about to determine whether it is more secure in right-angled abduction with 90 degrees of outward rotation (the usual position chosen, Fig. 101), or in right-angled abduction without any rotation, and the most secure position having been determined, it is put up permanently in that position.

When the limb is put up in the first position with the outer side of the thigh looking backward, if the head slips out, it will go forward into "anterior transposition," which for some cases is a good result. If the head slips out from the second position (back of thigh looking backward), it goes backward or upward and the result is not good, and the hip should be replaced at some later date.

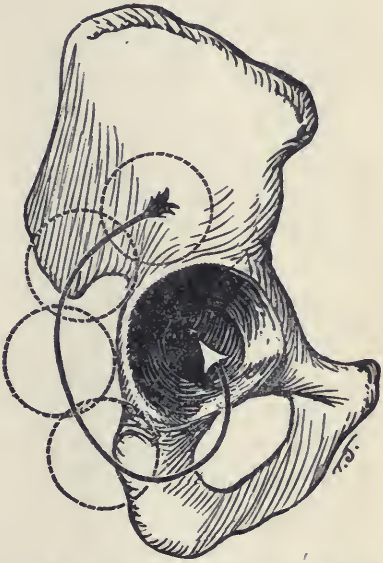


Fig. 101.—Diagram suggesting the course of the femoral head as it passes from its dislocated position above socket, backward and downward to the lower part of the socket where it enters.

To put on the permanent dressing the patient is clothed in a skin-fitting stockinette garment covering the body to the nipples and the leg (or legs) to the ankle. Then the patient is raised a few inches above the table and placed on a sacral and back rest, and the security of the hip in place is again tested. Then the patient is covered to the thickness of ¼ to ½ inch with sheet wadding bandages. These are bound firmly and smoothly down by the ordinary roller bandage. Then the plaster bandages are put on to make the plaster cast. The plaster splint ought to be at least ¼ inch thick on the thigh and at least ½ inch thick on the body. If the position chosen is with the outer side of the thigh looking backward, the plaster cast need extend only to the knee, but if the back of the thigh looks backward, the cast must be extended down on the leg with the knee bent at right angles to prevent the thigh from rotating into the other position, which is the one it naturally takes. At the top the cast is trimmed down to the free border of the ribs and it is trimmed out back and front to free the genitals and anus. Then the stockinette is turned over the outer side of the cast and drawn snug and sewed fast. Finally, before the child is removed to her bed we pass a thin towel between the body and the back of the cast, place a 2-inch pad of absorbent cotton held in gauze at the back of the body part of the cast and fold the towel ends over it and pin them fast. This towel and pad serve two purposes: First, they raise the child up from the bed so that she lies in the cast and not so that the cast lies on her; second, it catches any drip of urine. When she has been removed to her bed it may be necessary to place a small pillow under the thigh portion of the cast to relieve the inner condyle at the knee-joint from pressure of the cast.

The next case is a boy three and one-half years old with both hips dislocated upward and somewhat forward. The shortening as shown in the radiogram and as measured in relation to Nélaton's line is about 1½ inches. He stands with his lumbar spine curved forward—lordosis—the hips prominent and the thighs somewhat flexed on the pelvis and the legs somewhat flexed on the thigh. This deformity and shortening will gradually increase if he is left without treatment, and by the time he is fifteen years old may amount to as much as 5 inches. The radiogram shows very shallow sockets (Fig. 102), but the result of operating cannot be safely prognosticated from this alone. In some cases the radiogram may show the socket apparently good, but when the hip is replaced, it will be found very insecure. In other cases the socket may appear very shallow, but when the hip is replaced will be found to receive the femoral head and hold it securely in place.

I am accustomed arbitrarily to divide these hip cases into three classes for the sake of prognosis:

First: Those that are displaced backward and upward. The femoral head can be felt under the buttock muscles and cannot be felt in front on extreme outward rotation.

Second: Those displaced directly upward. The femoral head can be felt in front on outward rotation and at the back on flexion of the thigh and inward rotation.

Third: Those displaced forward and upward, in which case the head can be felt at the front and sometimes seen, but cannot be felt at the back on flexion and inward rotation.

About 80 per cent. of the first class give perfect results. Of the second class 60 to 70 per cent. give perfect results, while of the third class only about 50 per cent. give perfect results. The bilateral cases are in a class by themselves and these do not give perfect results in more than one-half of the cases. For some reason boys do not, as a rule, give as good results as girls. The outlook, then, in this boy with both hips dislocated is not very promising.

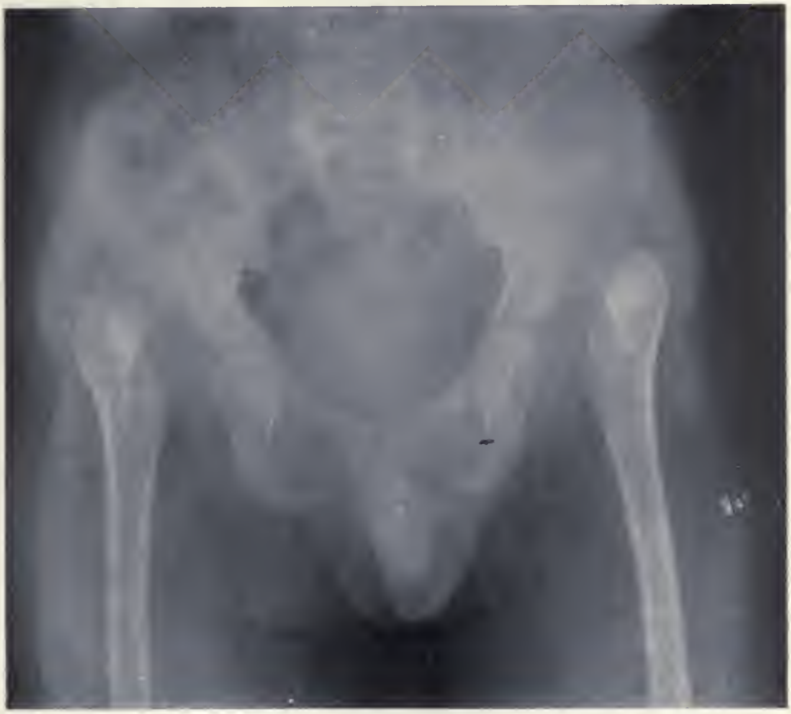


Fig. 102.—Case of bilateral dislocation with very shallow sockets.

I now replace these hips by the same maneuver that I employed in the other case, but instead of the hips slipping out as soon as I let go the legs, as I expected they would, both remain quite securely in place. The left hip is more secure than the hip in the child first operated upon, although from the radiogram we are justified in believing that the socket in the first case was considerably better than either socket in this second case. Both these hips are now put in a plaster splint in right-angled abduction with an outward rotation to 90 degrees. In this position, as in the other case, the child is able to lie comfortably in any bed, but if the limbs are placed with the back of the thighs looking backward, the knees bent to right angles to prevent rotation, and the cast carried halfway from the knees to the ankles, the child will not be able to lie comfortably in an ordinary bed. In the case of a single hip the foot and leg from the knee down can hang over the side of the bed, the foot supported on a stool and the limb covered with blankets, but in the bilateral case with both hips in this position, the child must lie continuously face down or upon a specially constructed bed, narrow enough to pass between the flexed knees. With the knees flexed and covered with a plaster cast it is obviously impossible for the child to walk, and inasmuch as it is necessary for the child to walk in the plaster cast for many months before it is removed to deepen and perfect the sockets, we are accustomed at the end of four months to cut off part of the cast below the knee and allow the limbs to rotate for the sake of enabling the child to walk, as we do when at the time of the operation the cast is extended only to the knees. It would seem almost impossible for this child to walk with the limbs in this—frog—position, but he will be standing in two or three weeks and ought to be walking in two or three months. To encourage these bilateral cases to walk we sometimes have a stool constructed or make use of the child's side-chair with castors on the legs of such height that the patient can rest the feet on the floor and push himself about the room.

In cases of this age the plaster cast—the first and only one—remains on the child for eight months. In older cases, where the shortening of the muscles is much greater, I am accustomed to remove the first cast at the end of about four months, and having brought the legs down nearer together, put on another cast, and sometimes, later on, a third cast, thus reducing the period of after-treatment by the passive manipulations which would be necessary to bring the legs together.

When the plaster cast is finally removed it is an interesting question in all cases whether or not the hips are going to remain in their sockets. I know of no certain way to tell; but if the legs can be readily brought down nearly together and if the joint motion in all directions is very good, I always feel that the hips are insecure; whereas, if the hips are quite stiff and the legs refuse to come down, it is highly probable that the result will be satisfactory.

The question is often asked: How long must these children remain in the hospital? There is no fixed time. These two children operated on today will leave after three or four days, as do most cases. Some cases leave the very day of the operation and are taken home a hundred or two miles before they begin to feel sore, and others, the difficult ones, remain a week or ten days, but I always let a child be taken home as soon as the parent can lift the child from the bed without giving enough pain to cause the child to cry.

The third case illustrates one of the partial failures and the way we manage them. This child, a girl now six years old, was born with both hips dislocated. When she was three years old I reduced both hips. The replacement was very easy and the sockets not satisfactorily secure. She was not a strong-muscled child. Her mother is a charming little lady and her father a college professor, not the kind that breed strong and tough stock. She wore the plaster cast eight months. The hips were in place when it was removed, but the legs came very easily down and were very soon side by side and she walked well. At some later time, just when we do not know, the right hip slipped out. The radiogram (Fig. 103) shows the left hip in place at this time and the right hip displaced forward and upward.

If our knowledge of the management of these cases was no greater than the knowledge which Lorenz possessed when he came over to operate on the relapsed hip of a celebrated case, our result might be no better than he obtained, but in the fourteen years since 1902 we have learned some things. We have learned that some hips that have never been dislocated slip out when the child walks with the limb adducted, as they have to do with the left limb when the right limb is in a plaster cast in right-angled abduction, as in our first case today, and that all replaced hips like the left hip in this third case will surely slip out if the child walks with the right leg in a plaster cast in right-angled abduction.

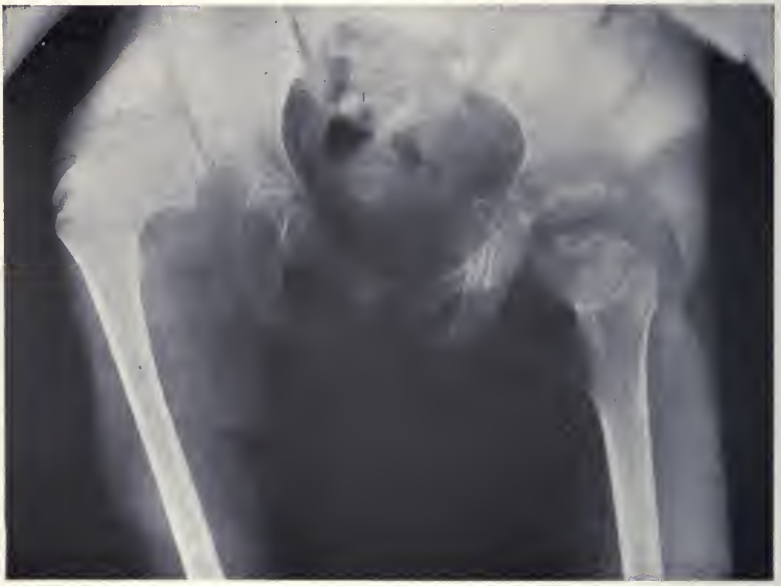


Fig. 103.—Recurrence of deformity on one side following reduction of bilateral dislocation three years previously. Hip replaced and *both* legs put in plaster cast.

So we will now replace this right (dislocated) hip by the usual method and put both legs in a plaster cast, the right one replaced today in right-angled abduction, and the other, replaced three years ago, abducted only slightly, hardly to the normal degree of abduction possible when standing. This will ensure stability of the left hip while the right hip is again being tried out.

When a replaced hip slips out at some time after the removal of the cast, it is always a question when it ought to be replaced.

I believe it to be an error to replace it at once, or even soon. It is better to wait and let the child walk on the leg until the shortening amounts to at least 1½ inches. Some years ago I replaced both hips in a little girl at about the usual age (Fig. 104). At some time after the removal of the cast one hip slipped out, the other remaining securely in place. I waited two years and then replaced the slipped hip. After the first cast was removed, it again slipped out. Then I waited five years and again replaced it. Since then it has remained secure. Here is the radiogram (Fig. 105) of a perfect result eight years after replacement, but you will note that the socket is still shallow and larger than the socket on the other side.

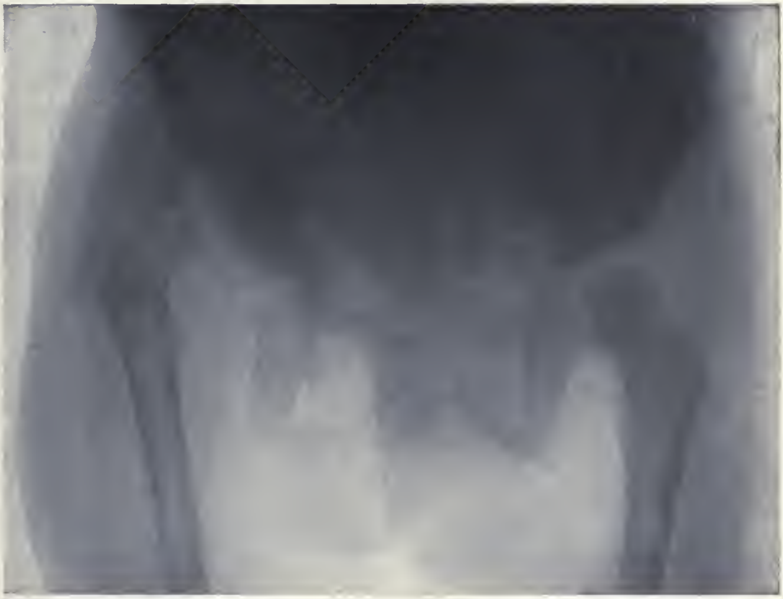


Fig. 104.—Walked at fifteen months, and limp noticed at eighteen months. Hip replaced January 11, 1906. Cast removed September 13, 1907. See final result radiogram August 30, 1913 (Fig. 105).

Here is the radiogram (Fig. 106) of a case of anterior transposition with the head turned forward and just above the socket, and an acetabulum so shallow that obviously the head could never be made to stay in place by any manipulation or operative procedure whatever.

Years ago I replaced a hip in a little girl and it slipped out. After about six months I replaced it again, and again it slipped out after the removal of the cast. Then the late Professor Hoffa, of the University of Berlin, replaced the hip by his cutting operation, boring out and deepening the socket to his entire satisfaction. When the cast was removed the radiogram showed the hip in place, but at the end of six months it had again slipped out.

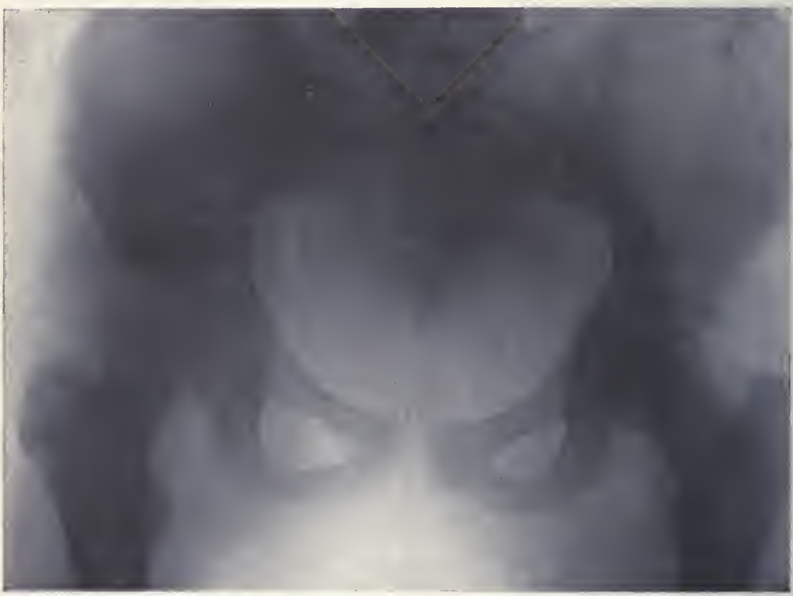


Fig. 105.—The radiogram was made eight years after the congenital dislocation was replaced. Clinically the result is perfect. The legs are the same length and with the same range of motion, and there is no limp, nor is there any clinical evidence as to which leg was the one operated on. But the radiogram shows clearly the difference between a normal and a defective hip.

Such I am sure would be the result if one attempted to replace this hip by a cutting operation unless a really stiff hip resulted from the cutting operation. In my experience all the hips replaced by the cutting operation that get a good range of motion ultimately slip out. Only those that are practically stiff remain securely and permanently in place, for you should know that the replacement of the hip by any cutting operation adds nothing to the strength of those parts which retain the hip in its place, but takes away to a greater or less extent the security of the hip.

Here is the radiogram of another child (Fig. 107). The hips were replaced when the child was three years and nine months old. After removal of the cast both hips slipped out. They were at once replaced. On removal of that cast both hips were in place. At the end of six months the right hip had passed forward and slightly upward and the left was still in place. By the end of a year they were both out. Three years after the first operation I again replaced both of these hips, that is to say, I placed the hips where they ought to be if in the sockets and where the femoral heads could be felt in front below the anterosuperior spines of the ilia and behind the femoral arteries, but in neither hip was there any sign of the head riding over the rim of the socket or of any socket-like depression. Nevertheless, I placed both legs in plaster casts, which she is still wearing. I have practically no hope that these hips will remain in place. Indeed, the

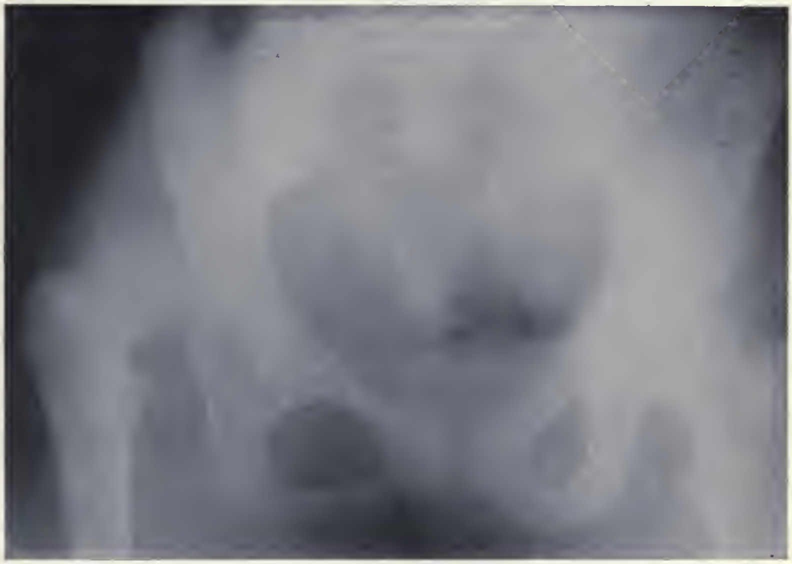


Fig. 106.—Anterior transposition with the head turned forward and just above the socket; acetabulum too shallow to justify attempt at reduction.

best result I hope for is an anterior transposition. With both hips in the anterior transposition the child will stand straight and walk well. The lordosis and prominent buttocks, flexed thighs, and legs will no longer be present, but a slight waddle will remain while walking. A younger sister of this child also had both hips dislocated. After replacement one has remained in place now for over a year and the other has turned into the anterior position, but can be readily turned back into the socket without discomfort to the child. I am waiting to see how it will be after two or three years more before considering other treatment.

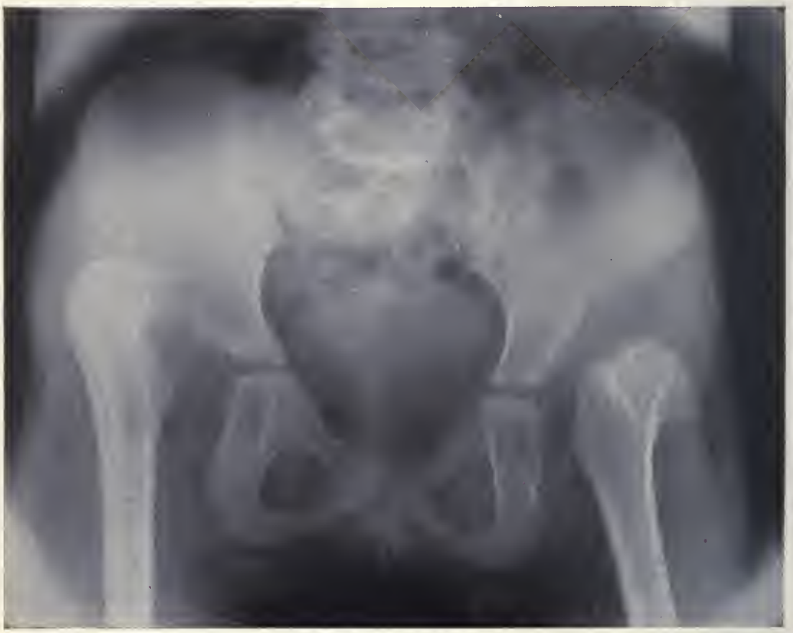


Fig. 107.—Both hips in anterior transposition. The acetabula are so shallow that improvement by operation is hardly to be expected.

It may be asked, What is the after-treatment when the cast has been finally removed in these cases of congenital dislocation of the hip? Usually none, except a gentle turning inward and stretching downward of the legs by the mother in her efforts to turn the toes directly forward and bring the limbs together.

CLINIC OF DR. ARTHUR DEAN BEVAN

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SURGICAL LESIONS OF THE COLON

Summary: Indications for operation on the colon divided into two groups, the first based upon the presence of definite organic lesions, and the second, upon a large assortment of so-called functional disorders; operations for the latter group of indications are usually examples of bad surgery and poor judgment.

Ileocecal tuberculosis; the clinical course and points of importance for diagnosis; the palliative and the radical treatment—when indicated; technic of radical cure—resection with ileocolostomy or ileocolostomy without resection as determined by the general condition of the patient and the local findings.

Carcinoma of the transverse colon; presentation of case operated on three years previously; discussion of the signs and symptoms and the method of examination.

Carcinoma of the sigmoid; the diagnosis; postoperative fecal fistula treated with bismuth paste; general carcinomatosis after four months.

Diverticulitis of the sigmoid; clinical similarity to carcinoma; complete relief from symptoms after colostomy; occasional association of diverticulitis and carcinoma.

Hernia of the diaphragm probably secondary to carcinoma at the splenic flexure of the colon; importance of looking for a possible cause of increased intra-abdominal tension when investigating hernias of the diaphragm.

Polypus of the sigmoid; method of examination which permitted a correct pre-operative diagnosis.

Calculus in the appendix causing repeated severe hemorrhages from the bowel.

Case illustrating the fallacy of extensive operation on the colon of patients with constipation, but without gross pathologic lesions; these operations are associated with an unwarranted mortality, and in the postoperative history of the majority of cases not only is there no improvement, but distressing complications, such as are recorded in the present case, are common; a careful, scientific analysis of the facts must force one to the conclusion that such operations are unjustified.

WE have several very interesting cases of surgical lesions of the colon which I desire to discuss with you this morning. Within the last ten years a great deal of development has occurred in the surgery of the colon. Some admirable advances have been made and a good deal of questionable surgery has been done. We might, in fact, divide these cases into two distinct groups, one where there were definite organic lesions demanding surgical interference, and the other a group of cases where surgical operations have been done for functional disorders, such as constipation and so-called intestinal stasis. Where there are organic lesions of the colon producing definite symptoms which can be relieved by surgical operations a great deal of good can be accomplished. Personally, I feel that the operations that have been done for functional disorders have, for the most part, been examples of bad surgery and poor judgment. I have analyzed this latter group with a good deal of care from the standpoint of a study of the literature of the subject, and from the cases which I have observed in my own clinic and in the clinics of others, and I have been forced to the conclusion that the surgical operations done on the colon for the relief of constipation and for intestinal stasis, for epilepsy and for various lesions, such as exophthalmic goiter, tuberculosis, and cystic disease of the mammary glands, on the vague and uncertain hypothesis that the conditions in the colon that could be removed by surgical operation are responsible for these conditions, have no value, and, in fact, the time has come when this sort of surgical therapy should be relegated to the museum of surgical errors and curiosities, which have no value and which are the result of mistaken enthusiasm often amounting to an obsession.

I shall first present a series of cases in which there are organic lesions demanding operative interference and shall operate upon several of these this morning. I shall then present to you several patients who illustrate clearly, I think, how unwarranted many of the operations are that are being done for constipation without an organic lesion.

CASE I

The first case is a very interesting one which Dr. Ralph Brown has referred to our clinic, and he has been kind enough to come here this morning to present the clinical picture and the clinical diagnosis. Then we shall make an exploratory operation and see what can be done for the patient.

Dr. Brown: The patient is a man thirty years old, who first came in on our service in November, 1910, giving the following history:

The patient was in Oklahoma in August and September, three months previous to his admission. He began to be troubled with constipation about the 4th of August and also a slight elevation of temperature in the evening. No headache, nosebleed, nausea, or vomiting were present. He went to a hospital in Oklahoma about the 5th of August, 1910. The patient states that there was a difference of opinion among the doctors. One thought the case was appendicitis and another diagnosed intestinal obstruction. He had very little pain, but had tenderness in the abdomen. Another doctor thought it was typhoid. He continued running a temperature, and on the 7th of September had a hemorrhage from the bowel. He thinks he had about four or five hemorrhages, losing about 17 ounces of blood at one time. It was easily distinguished as red blood. He became unconscious as a result of the loss of blood. He became better, and remained about the same until he came to Chicago the latter part of October. He had diarrhea at times during the latter part of the sickness.

At the time the patient entered the Presbyterian Hospital the physical examination was negative, with the exception that he was very thin and emaciated and anemic looking. His abdomen was somewhat tender, but there were no evidences of any fluid in the abdomen or any palpable masses. He was at that time running a temperature of a septic type, with remissions daily to nearly normal, and then running up to 103° and 103.6° F. This was in the latter part of November. This temperature continued until the first of January. The record from the Oklahoma hospital showed that he had been having the same type of temperature during all of September and October.

Here is a clinical picture in which a man was taken sick rather insidiously, with a temperature from the early part of August until January, associated first with constipation and later with a marked diarrhea, and relatively early in the case he had severe hemorrhages from the bowel. Examination at this time (November, 1910) showed the presence of blood in the bowel movements. The Widal was negative. His blood findings were those of a high-grade secondary anemia—45 per cent. hemoglobin, 8000 leukocytes, 4,088,000 red cells. Upon diarrheal management he recovered and gained about 40 pounds in weight and remained fairly well for a period of about two years.

He returned to the hospital in May, 1911, giving a history of a recurrence of the diarrhea, but under diarrheal management he regained his weight and was able to resume his occupation as a traveling salesman.

We next saw him in May, 1916, and at that time he gave the following history: In 1914 he had a recurrence of the diarrhea, with five or six stools a day. He thinks he had some fever during those attacks of diarrhea, which would recur occasionally. In 1915 the diarrhea became more constant, six stools a day, with loss of weight and strength, and finally he became so weak that he was unable to walk. At Thanksgiving, 1915, an operation was performed at one of the Chicago hospitals supposedly for appendicitis. We have the report of the operation, which I shall read:

"An incision is made in the region of the gall-bladder. The peritoneum is free, but the transverse colon, the hepatic flexure of the colon, and the ascending colon are all matted together and drawn into a knot in the neightborhood of the appendix. It is clear that the pathologic condition is tuberculosis. The glands in the neighborhood of the mesentery are enlarged. The abdomen is closed without delay."

The patient was put upon *x*-ray and violet-ray treatments. He had some diarrhea from the time of the operation. He came to us in April, 1916. At that time his condition was very bad. His blood findings showed 12,000 leukocytes, 3,500,000 reds, and 56 per cent. hemoglobin. He was having eight or ten stools a day. He was having so much abdominal pain that he required $\frac{1}{4}$ grain of morphin four times a day. His temperature was of a septic type, fluctuating from 99° to 103° F. The physical findings were negative with the exception of the abdomen. The abdomen was extremely rigid, and over the cecal region there was evidence of fluid, and one got the impression that there was a tumor mass, although the abdomen was very rigid. Proctoscopic examination showed a pale but otherwise normal mucous membrane up as far as 17 cm. from the anal ring. There was no evidence of any ulcerated or suppurative condition of the mucous membrane of the sigmoid. His lung findings were normal. At that time there was no evidence of any obstructive process in the colon.

He was placed upon accurate diarrhea management, and in nine weeks left the hospital, having gained 15 pounds, with a normal temperature and practically normal bowel movements. In the course of about two months he had gained 40 pounds and looked perfectly well and was having normal stools. His hemoglobin had risen to 77 per cent. by September. He left the hospital in June.

In September he came to me again, complaining of continuous pains in the abdomen with a tumor mass which he could feel just to the left of the cecum. Examination at that time showed the presence of a very distinctly palpable mass in the region of the cecum. It seemed quite certain from the physical findings and his description of the pain, that he had an intestinal obstruction based upon what was apparently a mass involving the walls of the cecum. Of course, from his previous history and the findings at the operation it was apparent that he had a tuberculous process in the colon, and to make sure I gave him a tuberculin test subcutaneously and got a very little rise of temperature on a 0.1 mg. dose. The next injection of 0.5 mg. gave only a rise to 100° F. Then I gave him 5 mg., and there was an extremely marked reaction. His temperature went to 104° F. That seemed conclusive evidence as to the nature of the pathologic process. Then we attempted to define the limits of it by the fluoroscopic and radiographic tests. It was perfectly clear from the tests that he had some infiltrative process involving the cecum and certainly the ascending colon. He was advised to have surgical relief, but thought he had better wait, so was sent home.

He came back a couple of weeks ago complaining of so much pain that he would have to have relief. x-Ray plates with barium were made, the barium being introduced with a tube. At the end of about seven hours there was still a retention of a great bulk of the barium in the lower part of the ileum. He is having a sufficient amount of pain to justify him in seeking relief. It is evident that he has a very high-grade obstructive process in the cecum involving a considerable portion of the ascending colon, and very likely we will find that the hepatic flexure itself is involved, because you can see in this plate that the hepatic flexure is pulled down and is probably involved in a mass of adhesions in the region of the ascending colon.

This case has been interesting from a number of points. It is interesting to me in the way in which it demonstrates that tuberculosis is essentially a benign process. Here is a man who has had tuberculosis for years. It has produced a high grade of sepsis and emaciation. The pathology of the case is of great interest because it shows one type of tuberculosis of the intestines, namely, the hyperplastic type, in which the lesion involves the cecal region and produces pathologic findings closely simulating malignant disease. It is also interesting because of the appearance of the hemorrhages of high grade early in the course of the disease. Clinically that is not common. It makes it easy to understand why the diagnosis of typhoid was made. The nature of the tuberculous process as it first involves the gut is usually a slow ulcerative process, with the production of sufficient granulation tissue to protect the surrounding tissues against perforation. The nature of that pathologic process is such that we do not very often get hemorrhage to the degree that we did in this case. For the same reason we rarely get a perforative peritonitis from the perforation of a tuberculous ulcer.

It may interest you to know that with microscopic work on the stools we were never able to demonstrate tubercle bacilli.

As to the pathogenesis of tuberculosis of the bowel in general, we may say that it is far more frequent than we ordinarily have any reason to suspect. Kaufman states that postmortem statistics show that tuberculosis of the bowel occurs in about 90 per cent. of the cases of pulmonary tuberculosis. In our case repeated examinations have never shown a pulmonary lesion.

Dr. Bevan: We are very much indebted to Dr. Brown for his presentation of the history of this case.

While the patient is being anesthetized I would like to say a few words in regard to the subject of surgical tuberculosis in the abdomen, using this case as a text. Of course we find a great many different clinical pictures. In a general way there are two types, at least as far as the involvement of the abdominal structures is concerned, one an involvement beginning in the peritoneum, the other beginning in the mucosa of the alimentary tract. A peritoneal tuberculosis is usually a hematogenous infection. You can understand that tuberculosis involving primarily the mucous membrane may be secondary to a lung infection from swallowing tuberculous sputum, or is a direct infection from food contaminated with tubercle bacilli. These two general types present very different symptoms. The type in which you have a hematogenous involvement of the peritoneum comes to the clinic very often as a case of hydrops with free fluid in the peritoneal cavity, and the differentiation has to be made between the different causes for fluid in the peritoneal cavity, such as lesions of the kidney, lesions of the heart, etc. Those cases come to the clinic very often with symptoms suggestive of other lesions, such as appendicitis, as gall-stone disease, with lesions such as tubal involvement in the female. In a general way the other type of tuberculosis involving the intestine comes to the clinic with two forms of complaint—the first, usually the presence of blood in the stools, and the second, evidence of more or less obstruction. Those are the two general forms in which abdominal tuberculosis is presented.

Now as to the case in hand. This case has been, I think, very carefully and scientificially worked up, both by the surgeon who operated previously and by the attending medical man. The case has been very carefully analyzed from every standpoint. He has already had an exploratory operation by a very good surgeon, who recognized that there was an extensive tuberculous process, and believed at that time that the best policy was general hygienic treatment. He was undoubtedly right at that time because the patient's condition was so very bad. As Dr. Brown has told you, the patient comes to us now with a pretty definite pathologic diagnosis and anatomic diagnosis; the pathologic diagnosis, as determined by the previous exploratory operation, and the general clinical picture and the anatomic diagnosis, as determined by a mass which is distinctly palpable and more definitely determinable by a very careful *x*-ray examination. From the evidence obtained the obstruction probably extends from the middle of the transverse colon to a point a little above the ileocecal region. The important clinical fact is that he has definite intestinal obstruction of a chronic type that must be relieved.

What are we going to do about this case? In view of the definite and rather high-grade obstruction, I quite agree with the conclusion that has been arrived at that we should give this man the benefit of surgical relief. What can we do in a surgical way? One of two things, either a removal of the entire mass and a side-to-side anastomosis, between the part of the ileum that is not involved and the part of the transverse colon that is not involved; or, if this is impossible or is not advisable, then simply an anastomosis between the part of the ileum not involved and the part of the transverse colon not involved.

The statistics on this subject are very interesting. Where it is possible and good judgment, considering all facts in the case, a radical operation should be done, because it gives a much better prospect of a permanent and complete cure. On the other hand, there are a certain number of cases in which it is not easy to do this, and good judgment would dictate an anastomosis rather than a very severe operation carrying a large risk with it.

Operation.—We shall operate upon this patient under ether anesthesia. I am making the usual midline laparotomy below the umbilicus. There is one interesting fact that we may find. The previous operator found, when he explored this abdomen, that the peritoneum was studded with tubercles. We may find that they have all disappeared. We have had that experience a number of times at the second laparotomy. A peritoneal tuberculosis which was very distinct at the first operation had disappeared so completely as to leave no trace.

As I open this peritoneal cavity I find that the peritoneum is quite smooth and shows no evidence of tuberculous peritonitis. The first thing that comes into view is the small intestine, which is very greatly distended. As I examine this, I find that it is the lower end of the ileum. As I follow it to the ileocecal valve I come to a very large, hard, nodular mass which is an ileocecal tuberculosis. It will be necessary, in order to expose this lesion fully, to extend my incision up above the umbilicus, which I now do, exposing the abdominal contents more thoroughly, and follow this mass from the cecum upward, and find that it involves the ascending colon and about one-half of the transverse colon, and that the left half of the transverse colon is normal and not involved in the process (Fig. 108). It is a question whether we should make here a resection or an anastomosis. The man is in fairly good condition, and inasmuch as a resection will hold out a much larger chance of permanent cure, I am going to undertake this more formidable operation rather than do a simple anastomosis.

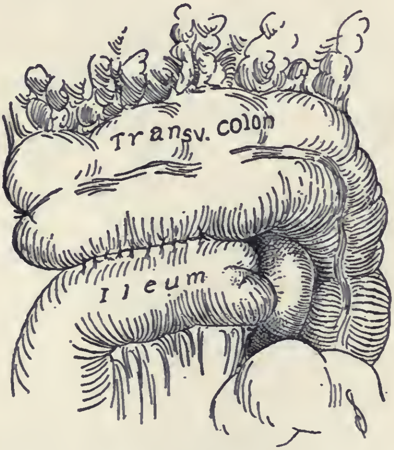

Fig. 108.—Ileocolostomy. Lateral anastomosis between transverse colon and ileum.

I divide first the outer layer of the mesocecum and the mesocolon of the ascending colon. This is a non-vascular layer. I bring the cecum, ascending and transverse colons, and the first 1½ feet of the ileum out of the wound. I then ligate the mesentery of the last foot of the ileum and the mesenteries of the cecum, ascending, and half the transverse colon. I cut the mesentery

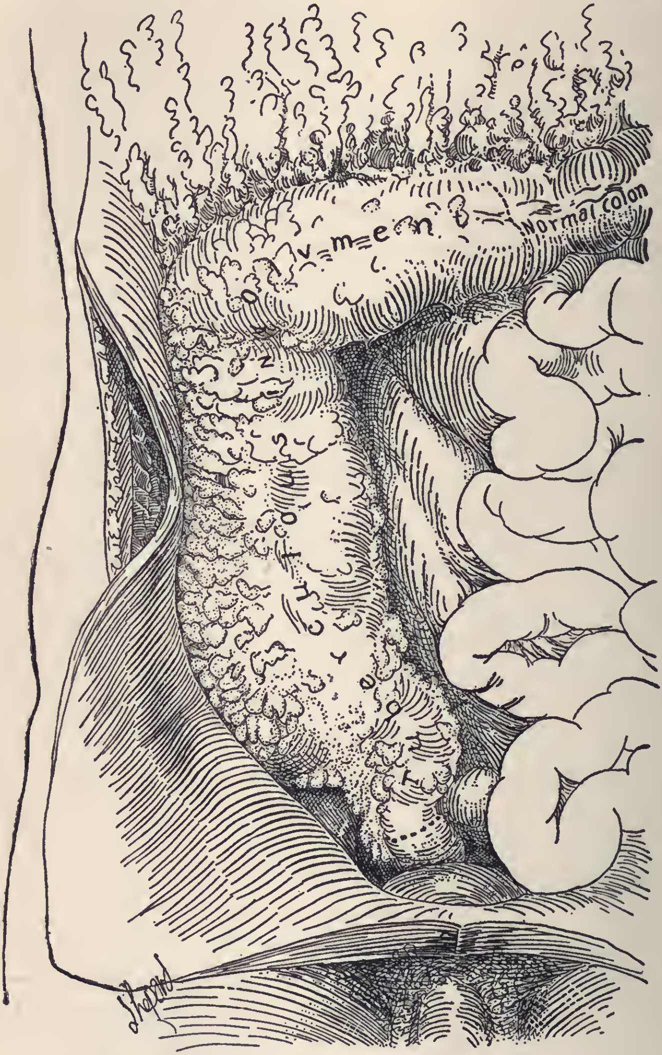

Fig. 109.—Hyperplastic tuberculosis of cecum.

distal to the ligature. I now clamp with heavy crushing clamps the ileum well beyond the tuberculous process, and tie a strong silk ligature around the bowel where I have crushed it with the clamp, and divide the bowel beyond the clamp and invaginate the divided ileum with two purse-string sutures so as to close completely the intestine at this point. I do the same with the transverse colon, so that I now have the entire mass removed and the transverse colon at a normal point completely closed and the ileum at a normal point completely closed. I now make a lateral anastomosis between the transverse colon and the ileum, just the way that we would do a gastro-enterostomy (Fig. 109). I am using in this anastomosis three rows of sutures, one for the mucosa, one for the muscularis and peritoneum, and the third a Lembert suture. The structures are now dropped back into the abdominal cavity and the wound closed, leaving, however, two cigarette-drains about the size of my little finger down to the point of anastomosis.

I shall ask Dr. Brown to demonstrate the specimen.

Dr. Brown: This is an unusually beautiful pathologic specimen, and shows practically all the features that are characteristic of the hyperplastic type of tuberculosis which has this ileocecal region as its site. First of all, there is this enormous thickening of the wall, which in some places has the thickness of fully an inch. Before opening the gut it was apparent that there was a point of very marked stenosis, and that is situated about 3 inches proximal to the ileocecal valve. There is an opening here which will hardly admit my little finger. Upon opening the gut there are to be seen areas of ulcerations with scar-tissue formation. There is one ulcer nearly healed which formed the basis of this marked constriction in the lower part of the ileum. There is another ulcerated area here in the ascending colon—a nearly healed ulcer. The most striking part of the picture is the enormous polypoid development of the mucous membrane between these tuberculous ulcerations. Some of these polypoid formations are fully an inch in length.

CASE II

The second case is a patient I operated upon four years ago, and I am presenting him to you as an unusually gratifying result in colon surgery, a case of carcinoma of the transverse colon resected in 1913. The patient made an excellent operative recovery, and has remained well without recurrence for more than three years. The history is as follows:

Mr. N. H., age sixty-five. Referred by Dr. Sippy. Patient entered the hospital October 9, 1913. He has always been in good health until the spring of this year, when he began to have *pain in the abdomen.* This pain is distinctly colicky, cramp-like, and quite severe at times. It is usually present each day, but may be absent for as long as two or three days at a time. Pain usually lasts one or two minutes at a time, coming and going throughout the day. It is almost always accompanied by a desire to defecate, and the passage of stool or flatus invariably gives relief. Patient states that lately there has been an almost continual desire to go to stool. He usually has four stools a day, the tendency being to mushy movements. Rumbling and passage of flatus has increased markedly of late, and much mucus, but no blood, has been passed. The pain always starts in the suprapubic region, and the patient is sure that he can feel an increased resistance, or a lump, under the skin on the left side, but he has felt no movements in the abdomen. Nausea is present at the height of distress, but vomiting has occurred only once. He has lost about 10 pounds in weight in the last few months, and has noticed that he is much weaker. He has limited his diet to almost nothing on account of the pain.

On physical examination the patient appears to be a fairly well-nourished individual, although he has evidently lost some weight. Except for an adenoma in the left lobe of the thyroid and tinea versicolor over the chest there are no physical abnormalities outside of the abdomen. There are marked peristaltic waves over the abdomen and splashing is heard upon succussion just above the umbilicus. Gurgling is present before bowel movements. Upon dilating the stomach with soda and tartaric acid distinct peristalsis is visible, but separate bowel peristaltic waves are also present, rising as transverse ridges below the stomach and accompanied by cramp-like pains. Repeated seven-hour motor meals show no retention of food. An Ewald test breakfast —total acidity, 71; free hydrochloric acid, 59. On several occasions aspiration showed no free acid and a positive guaiac test for blood. This was thought to have been due to traumatization of the aspirating tube. Twenty-one stools examined for blood were negative and 15 were positive. Microscopic examination of the stools failed to reveal pus. A barium injection shows a definite defect of the large bowel in the region of the splenic flexure. The diagnosis made by Dr. Sippy before the patient was transferred to the surgical service was chronic intestinal obstruction of the splenic flexure of the colon due to malignant growth.

Operation Notes.—Under ether anesthesia the Bevan S-shaped incision is made on the left side. An annular carcinoma of the transverse colon at once comes into view. There is no evidence of glandular involvement or of secondary deposits in the liver. Exploration fails to reveal a lesion of the stomach. There is marked hypertrophy of the proximal portion of the bowel. About 8 inches of the colon are resected, including the tumor growth. The ends are closed with three rows of linen sutures and the usual three-row lateral anastomosis made. The wound is closed without drainage.

I am very glad to have the opportunity of presenting this case to you because it illustrates very well the possibility of permanent cure in carcinoma of the large bowel if the case is operated upon at a time when the lesion is limited entirely to the intestine and to the block of tissues that can be removed at the time of the operation. Fortunately, in this case the circular carcinoma gave very early and definite symptoms, and fortunately for the patient he was referred to Dr. Sippy's service, where the condition was at once diagnosed and he was given the benefit of radical surgery.

CASE III

The third case, patient W. S., sixty-six years of age, presents a number of unusual and interesting features. The history is as follows:

Patient entered the hospital September 13, 1916, with the following complaints: pain in the abdomen; marked constipation; rumbling of gas in abdomen.

About the 1st of July the patient began to have some indefinite pains that he thought were due to indigestion—also some constipation. About August 1st (five weeks ago) patient began to have rather severe cramp-like pains in the left side of the abdomen accompanied by marked rumbling. At the onset pain would occur on the second day after a bowel movement, usually beginning in the afternoon. Constipation grew progressively worse until cathartics would not produce a movement. At one time he went seven days with no movement in spite of the free use of cathartics and enemas. He had five copious stools at the end of this time. During this period the abdomen was very distended and so tender it could not be touched. Vomiting occurred once.

Patient has always been well until a year and a half ago, at which time he had pneumonia. His bowels have always been regular without the use of any cathartic until four months ago. He was shot through the mouth ten years ago, the bullet taking out some teeth and grooving his tongue. Six or seven years ago he developed a small sore at the corner of his mouth, which disappeared and reappeared at intervals until last February, when it commenced to grow. He was operated upon by Dr. Bevan July 7, 1916, and an epithelioma removed. There has been no evidence of recurrence.

One year ago the patient weighed 250 pounds. His present weight is 200 pounds. His appetite has always been excellent until lately, when he has limited his diet on account of the pain. His family and venereal histories are entirely negative.

Physical examination does not reveal anything of importance except that the abdomen is covered by a thick layer of fat and is very distended and tender, which makes palpation of any tumor mass out of the question. Leukocyte count, 9050; hemoglobin (Dare), 92 per cent.; blood pressure, 150; urine, negative.

Fluoroscopic examination shows an area in the sigmoid 3 or 4 inches below the splenic flexure which does not fill. There is a small shadow through this area. Plates show an almost complete obstruction, about 2 inches in length, 2 inches above the crest of the ilium.

Operation.—Under anesthesia a large muscle-splitting incision, similar to an appendix incision, is made on the left side. A circular constriction of the large intestine is found at the site

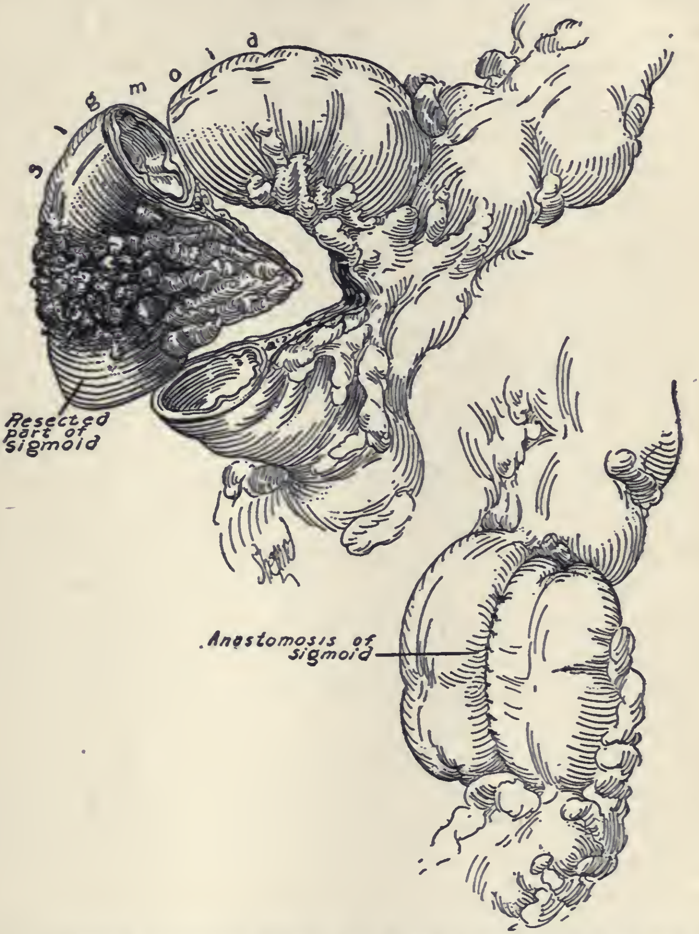

Fig. 110.—Lateral anastomosis between two loops of sigmoid following resection for carcinoma.

shown in the *x*-ray. This may be a carcinoma or diverticulitis. The outer leaf of the mesentery of the descending colon is divided by blunt dissection and some adhesions are separated. The blood supply going up in the inner layer of the mesentery of the sigmoid is ligated. The operation is made very difficult by the large amount of fat in the abdominal wall and in the abdomen. The tissues are very friable, and in an attempt to handle the distal stump of the resected bowel by ligation and invagination the ligature slipped off the friable tissues, making a three-row suture closure necessary. Fortunately, the abdomen is not soiled. The proximal end is likewise closed with three rows of sutures. Five inches of intestine are resected. On opening this we find that the lesion is definitely carcinoma. The usual side-to-side anastomosis is made (Fig. 110). There is no evidence of glandular involvement. The wound is closed, leaving two cigarette-drains to the site of anastomosis.

This man made a fairly good operative recovery, although the wound suppurated for a time and a fecal fistual developed in the center of the laparotomy wound. Fortunately, this closed completely without necessitating further operative interference. The closure I think was materially aided by injecting the fistula with a very thick stiff bismuth paste for a number of weeks after the operation. Unfortunately, now, at the end of about four months, he shows evidence of a general carcinomatosis with definite lung involvement. This is one of that large number of intestinal cases where the condition was not recognized until the process had already become wide-spread and probably systemic before operation was undertaken.

CASE IV

The next patient which I present to you is a very interesting duplicate in a way, and at the same time a contrast, to the previous case. The patient's history is as follows:

Patient, Miss S. R., age sixty-eight. She entered the hospital September 7, 1916, and at the time of admission gave the following history:

She has been perfectly well until four weeks ago, but has had intermittent trouble ever since. During this time she has lost 10 pounds in weight, her maximum being 115 pounds. The trouble began acutely, with nausea, vomiting, and pain in the lower part of the abdomen. This pain was low down in the pelvis and accompanied by some discomfort in the sacral region. After some hours' duration the pain subsided sufficiently to allow the patient to sleep. The following morning she had several attacks of pain of the same character lasting but a few minutes at a time. There was an accompanying desire to go to stool, but patient had no bowel movement. Since then she has had the same straining at stool every two or three days, accompanied by cramp-like pain which would be relieved by bowel movement. There is no history of the passage of blood or mucus. There has been no gurgling or rumbling since the onset of her trouble. Her appetite has been poor and her diet markedly limited.

Physical examination reveals a poorly nourished woman. Both kidneys are palpable to the first degree. The descending colon and cecum are palpable, but not tender. Rectal examination shows a mass which is movable and smooth and just within the reach of the palpating finger. This mass could not be palpated abdominally.

x-Ray examination demonstrates an almost complete stenosis of the sigmoid, about 12 inches above the anus. There is marked enlargement of the sigmoid above this point. Leukocyte count, 8700; hemoglobin, 73 per cent. (Dare); urine, negative.

Stools are all negative to the guaiac test for blood.

Operation.—Under ether anesthesia the usual midline suprapubic laparotomy incision is made. There is a large mass, probably carcinoma, plastered to the rectum. Mesentery of the sigmoid is short, adding to the difficulties of the operation. The mesosigmoid is cut and the peritoneum separated from the upper part of the rectum. The bowel is now ligated well below the mass and cut in two. The rectal stump is invaginated with two purse-strings over the ligated end. The peritoneum that has been stripped off the sigmoid is used with the left broad ligament to cover over the rectum and wall off the pelvis. The peritoneal cavity is left perfectly smooth. The sigmoid is divided above the tumor mass, resecting about 8 inches of bowel. A left-sided muscle-splitting incision is made. The free end of the bowel which has been cauterized is brought out through the incision and stitched in position, making a permanent colostomy (Fig. 111).

The patient's pulse is somewhat rapid at the close of the operation, but her condition is good.

We had here what to gross appearance looked very much like the lesion in the previous case, and we regarded it as a carcinoma. A very careful histologic study, however, has shown that it was a huge mass of tissue involving the sigmoid developing from a diverticulitis and peridiverticulitis; the microscopic examination has failed to show any evidence of carcinoma.

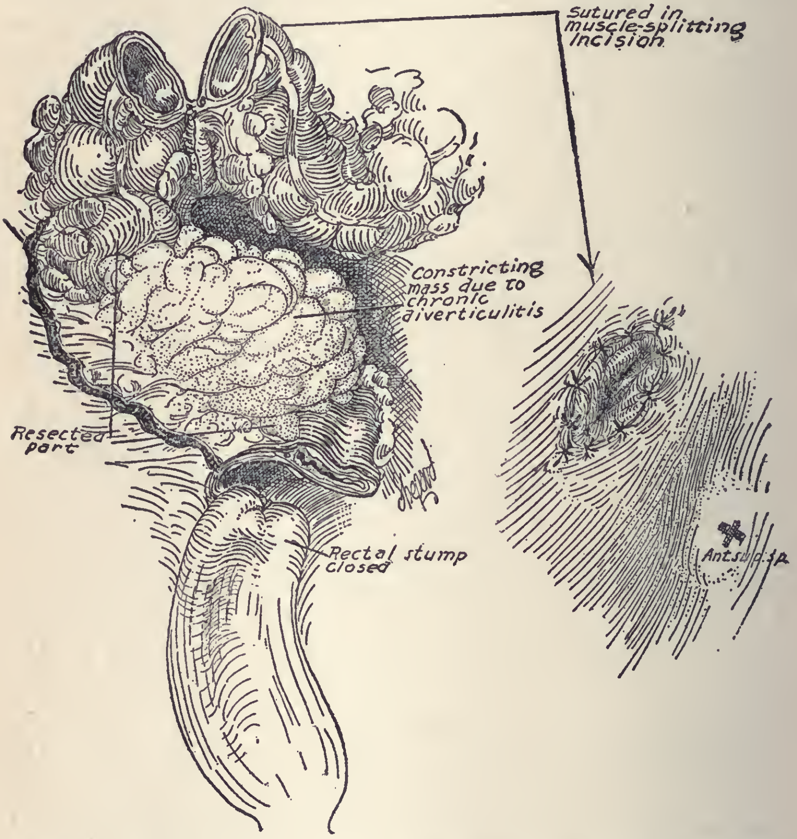
Sutured in muscle-splitting incision
Constricting mass due to chronic diverticulitis
Resected part
Rectal stump closed
Ant.sup.sp.

Fig. 111.—New inguinal anus. Portion of bowel resected for chronic diverticulitis.

This patient, as you see, has made a very satisfactory operative recovery. The mass was situated in the sigmoid very close to the rectum, so that even had we known at the time of the operation that the process was not malignant, it would have been difficult to handle the bowel in any other way than that of making a permanent colostomy, at least with any degree of safety. This case illustrates a considerable group of cases which we have had where at the time of operation it was impossible to make a definite diagnosis between carcinoma of the sigmoid and peridiverticulitis. Then, too, there is this to be said, that not infrequently cases of peridiverticulitis which do not show any evidence of carcinoma at the primary operation are followed later by definite malignant recurrences, demonstrating the fact that they were carcinoma in the first place, although there were no evidences of the latter in the microscopic section.

CASE V

I want now to show you a gross pathologic specimen from another colon which is unique in my experience and which, I think, is very instructive. The patient was referred to me by Dr. Bertram Sippy with the demonstrated diagnosis of "hernia of the diaphragm," and was operated upon for that lesion. The history is as follows:

Mrs. E. L., age fifty-five.

Present Complaint.—Pain in abdomen, vomiting, difficulty in swallowing, weakness, jaundice, loss of weight, and constipation.

Onset and Course.—Patient states that her present illness began suddenly ten weeks ago with a sharp pain in the abdomen just above the umbilicus, associated with vomiting, jaundice, and a general feeling of depression. At the onset the pain was not severe except when she was up and about or after food taking, but was present to some extent all the time. This condition continued to grow gradually worse until six weeks ago, at which time she was forced to remain in bed because of the severity of the pain. Since then the pain and vomiting have been markedly increased and have been very severe, at times independent of exertion or of food taking. *Pain* is sharp, cramp-like, and usually across the abdomen just above the umbilicus. It radiates mostly to the left side. It has never been definitely localized at any one point, and there has been very little in either the right lower quadrant of the abdomen or in the region of the gall-bladder. There has been no radiation of the pain. It has always preceded the attacks of vomiting and has been most severe after food taking or exertion. The pain is relieved by vomiting, by rest in bed with knees drawn up, and by drinking small amounts of water. Relief seems sometimes to be obtained from bowel movement. The *vomiting* has always been preceded by severe, sharp pain. At its onset it appeared only after the pain, but lately it has been independent of everything else, occurring at irregular intervals.

Difficulty in swallowing solid foods began six weeks ago, and since that time all solid foods have been vomited immediately. They seem to stick and not to pass into the stomach. There has been no difficulty in drinking small amounts of liquid.

According to the patient, there has been some *jaundice*, but a careful investigation among her friends does not reveal any history of a well-defined jaundice.

Patient states that her *bowels* have always been constipated and that she has taken cathartics for several years. The bowel movements have always been soft and mushy. For the past six weeks she has been unable to obtain a movement without the aid of enemas and results have been very slight even with these. Rumbling and gurgling in the abdomen has occurred a number of times a day associated with cramp-like pains.

Her maximum *weight* was 210 pounds (three months ago). Present weight is 153—a loss of 57 pounds.

Past History.—Patient had the usual diseases of childhood; malaria about thirty years ago. She also had some stomach trouble twenty-five years ago, but with the exception of colds she has been well since that time until the onset of the present trouble. Her menopause occurred at fifty-one and there has been no bleeding since.

Physical Examination.—The head and neck are negative except for marked pyorrhea. There is a decided acetone odor to the breath. There is slight respiratory mobility; there is prolonged roughening of expiratory breath sounds over the left posterior border of the lung and a high-pitched note on percussion over the same area. The left border of the heart is 10 cm. from midsternal line. Rhythm is regular. The tones are faint, but no murmurs are to be heard. There are no localized areas of tenderness in the abdomen and no tumor mass can be palpated.

x-Ray Findings.—As barium was swallowed it was seen accumulating in the position, apparently, of the lower end of the esophagus. By placing the patient on the right side on the table the shadow was found to project above the diaphragm and to be continuous with the stomach shadow below the diaphragm. With the patient properly placed this was definitely shown not to be continuous with the esophagus, and to be a hernia of the stomach into the thoracic cavity.

I will show you the postmortem findings: Here is a small carcinoma at the splenic flexure of the colon which was entirely missed at the time of the operation. As we analyze the facts there can be no doubt but that it was this carcinoma causing a gradual distention of both the large and small intestines, especially the large intestine proximal to the malignant obstruction which was the causative factor in the production of the hernia of the diaphragm. In other words, the increasing intra-abdominal tension due to the carcinomatous obstruction finally reached such a point that the esophageal opening was gradually stretched and a considerable part of the stomach was forced through this opening in the diaphragm into the thoracic cavity. I do not know that this condition has been noted before, but clearly we have here an example of obstruction in the intestinal tract with increasing abdominal tension producing a diaphragmatic hernia. Certainly in the future in cases of diaphragmatic hernia I shall take into consideration the possibility of an increase of intra-abdominal tension from an obstruction being the etiologic cause.

The operative notes on this case are as follows: Ether anesthesia. A large S-shaped incision through the left rectus. On opening the abdominal cavity and introducing the hand along the stomach to the esophageal opening a very large esophageal opening is found, through which a part of the stomach has passed into the thoracic cavity. The intestines, especially the transverse colon, are greatly distended with gas. I examine the colon

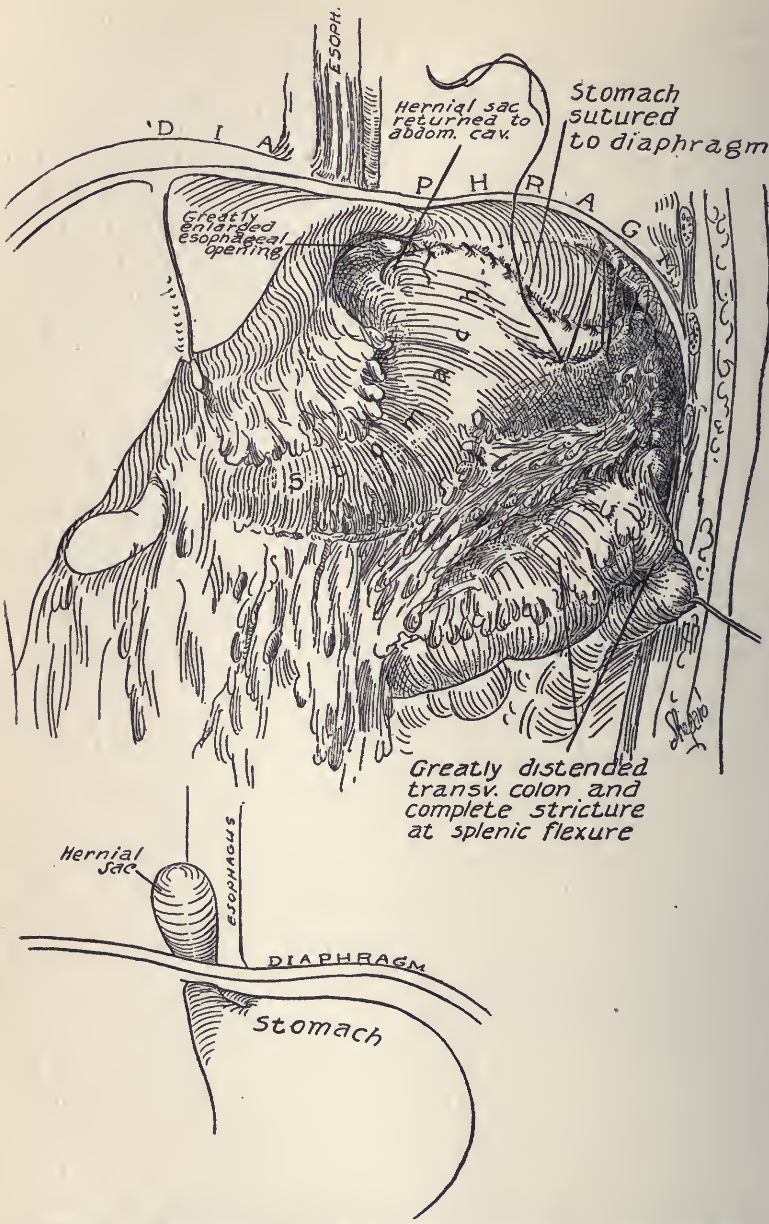
ESOPH.
Hernial sac returned to abdom. cav.
Stomach sutured to diaphragm
D I A P H R A G M
Greatly enlarged esophageal opening
S T O M A C H
Greatly distended transv. colon and complete stricture at splenic flexure
Hernial sac
ESOPHAGUS
DIAPHRAGM
Stomach

Fig. 112.—Diaphragmatic hernia secondary to carcinoma of the splenic flexure of the colon. The sketch inserted in the lower part of the plate represents the relative size of the hernia as found at operation.

below this point down as far as the rectum, but can feel no obstruction. I complained bitterly to my assistants that the patient's bowels had not been thoroughly cleaned out before the operation, but they said they had followed the usual routine of mild cathartic and enema, and the nurse had reported that these were followed with good results. There was so much difficulty in reaching the esophageal opening on account of the distention of the bowel that I satisfied myself by stitching the herniated part of the stomach, after I had drawn it down, to the diaphragm with two rows of sutures. The abdominal wound was closed. Pads and sponges were accounted for.

The patient died within twenty-four hours apparently from shock and great distention of the abdominal cavity. It was not until the postmortem was made that this small circular carcinoma of the splenic flexure was found (Fig. 112).

CASE VI

The next case is one in which most careful and prolonged observation and examination led to a brilliant diagnosis. Dr. Sippy met me at the hospital one morning some time ago and said that he wanted me to operate upon a patient with a polypus of the sigmoid. I said, "Can you feel the mass?" He said, "No." I said, "Then how did you make the diagnosis?" He said, "I have had her under observation for some time. She has had bleeding from the rectum for a number of years. Her general condition is good, so good, in fact, that with the long history of bleeding carcinoma is probably eliminated. Examination of the rectum and lower sigmoid with the proctoscope shows no cause for the hemorrhage. A careful examination shows nothing abnormal in the stomach or duodenum. The blood is either bright red or in clots. When we have a constipated stool there is no blood in the center of the stool mass, but simply on the external surface. The center of the stool is Weber negative. The outer surface is Weber positive. These stool masses are formed in the sigmoid, therefore I conclude that the lesion is in the sigmoid; that on account of its long history it is not carcinoma, and, therefore, probably polypus."

The operative notes are as follows: On January 8th the patient was transferred from the medical service, with a diagnosis of "polyp of the sigmoid." Under ether anesthesia a midline suprapubic incision is made. Careful exploration reveals a few adhesions about the sigmoid which are not sufficient to account for the symptoms. In the lower portion of the sigmoid there is a nodule about the size of a walnut, which is evidently attached to the wall of the bowel. Two stomach-clamps are placed upon the

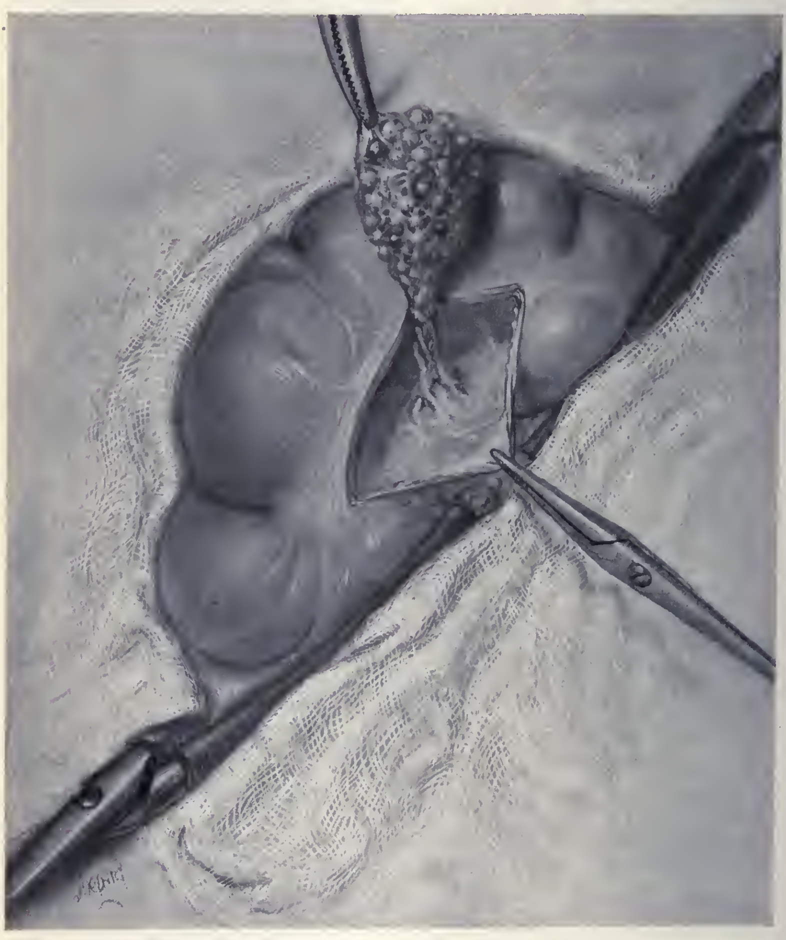

Fig. 113.—Removal of polypus from the sigmoid.

gut to prevent extrusion of feces and a longitudinal incision made over this mass. An eroded pedunculated mucous polyp comes into view. This is removed by ligation of the pedicle and closure of the raw area with linen (Fig. 113). Bowel is now closed by three rows of linen. The abdomen is closed without drainage.

The patient made a good recovery and has had no evidence of hemorrhage since operation. Microscopic examination showed the specimen to be a polyp.

CASE VII

A second most interesting colon case with hemorrhage is the next one, a patient of Dr. Frank Billings. The patient has had for six years repeated severe hemorrhages from the bowel. These have not been associated with pain, and, although she has been under most careful observation for a long period, the cause of the hemorrhage has not been demonstrated. The patient is a married woman of forty-six. The hemorrhages have occurred at intervals and have been so severe that after some attacks the hemoglobin would go down to 40 per cent. The history of the case was very much like the one that I have just described. The bleeding had been going on intermittently for six years. There was no evidence of carcinoma. *x*-Ray examinations with barium injection in the colon were negative. Proctoscopic examination was negative, and for some time it was felt that the hemorrhage must be due to some constitutional condition and that medical management was indicated. However, as the condition persisted without relief, Dr. Billings suggested that an exploratory operation be made. When I analyzed the facts in the case I thought that we had to deal, probably, with a polyp in the colon at some point, and ventured that as the most probable diagnosis.

Operation under ether. Exploratory incision in midline. A most careful examination of the alimentary tract was made. The large bowel was empty and contracted. The sigmoid was examined and no polyp or lesion of any kind could be found. The cecum was rather contracted. Appendix examined. It was found to be large and contained a large fecal stone at the junction of the appendix and the cecum, the stone seeming to project into the cecum. Distal to the stone the appendix was distended with a soft mushy mass. The rest of the intestinal tract, from the stomach down, was carefully examined, but no pathologic condition found except this large appendix as described. The ap-

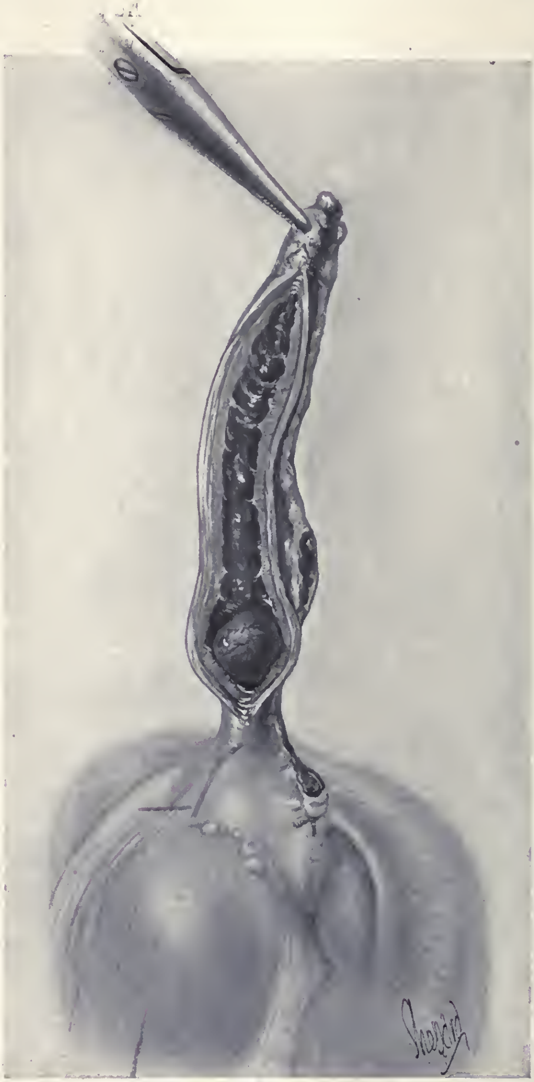

Fig. 114.—Stone in the appendix which caused repeated severe hemorrhage.

pendix was removed in the usual way, and, as seemed apparent before its removal, the stone was very close to the junction of the appendix and the cecum and occupied sort of an ampulla at that point. When the appendix was split open distal to the stone there was a considerable mass of tarry material which was strongly Weber positive (Fig. 114).

The patient made a good recovery from the operation and has had no evidence of hemorrhage since that time. If she has no more bleeding, it will demonstrate conclusively that this stone in the appendix was the cause of the hemorrhage. I have never met with this condition before, and yet there is no reason why a stone in this position should not be the cause of hemorrhage and even considerable hemorrhage, just as a stone in the kidney can produce considerable hemorrhage. I am glad of the opportunity of presenting this case to you and of putting the facts on record.

CASE VIII

Lastly I want to demonstrate a case which illustrates the fallacy of doing extensive colon work on patients with constipation but without any gross pathologic lesion or obstruction. This patient, a woman of forty-two, is referred to me by Dr. Sippy. The patient came to the hospital December 10, 1915. She has had a very severe case of constipation as long as she can remember and has taken cathartics and enemas daily for years. Her general complaints now are general weakness, abdominal distention, rumbling and crackling in the intestine, and very marked and positive peristalsis, loss of appetite, and loss of weight.

In March, 1914, she was operated upon by a very excellent surgeon, who did an ileosigmoidostomy on account of the severe constipation which it was thought could not be controlled in any other way. For two or three months following the operation she had from three to six watery stools a day. Since that time her symptoms of constipation have been much worse than they were before the operation. She has been advised to have the entire colon removed.

x-Ray examination shows that barium injected into the colon fills up the cecum and ascending and transverse colon and remains in that position for weeks. The same condition occurs if the barium meal is given from above. There is evidently a large neurotic element in her case, but there also is now a very definite gross mechanical difficulty in the intestinal tract. At times very marked peristalsis of the intestines can be seen and felt, and this is associated with cramp-like colics and great distress.

After analyzing all the facts with Dr. Sippy, we concluded to restore the intestinal tract to normal, and then place the patient upon scientific medical management for her constipation.

Operation.—Under ether a midline laparotomy incision was made below the umbilicus. The anastomosis between the ileum and the sigmoid was brought into view. The cecum, ascending and transverse colons were found packed full of fecal matter. The anastomosis between the ileum and sigmoid was separated and the opening in the sigmoid was closed and the integrity of the ileum was restored by a side-to-side anastomosis. The wound closed without drainage.

This woman made a very excellent operative recovery in spite of the fact that her entire colon was packed with fecal masses. Gradually, with mild cathartics and oil injections from below begun some days after operation, we got rid of the fecal masses impacted in the colon, and under good anticonstipation treatment the patient went on to a complete recovery as far as her bowel disturbance was concerned.

This is but one of several cases where we have had to restore the intestinal tract to normal after these operations of ileosigmoidostomy have been done for constipation. It seems to me that an analysis of Lane's work, and Lane, as you know, is more than any one else responsible for the development of these operations for constipation, and an analysis of the work done by men who have followed his suggestion show conclusively that these operations are associated with an unwarranted mortality, and that the after-history of a great majority of the cases shows not only no improvement, but often distressing complications such as occurred in this case. To me there is no longer any question but that these operations are illogic and unwarranted and have no place whatever in modern scientific surgery. I feel very strongly on this point. Today, all over the United States, operations are being done on the colon for constipation and for symptoms which are supposed to be due to intestinal stasis, and for epilepsy, and for other conditions, operations which are not only of no value to the patient, but which carry a good deal of risk of immediate operative mortality and a much larger risk of permanent disability from adhesions and interference with the normal function of the intestinal tract. These operations are done often by men who are good technicians and enthusiastic surgeons, but certainly a careful scientific analysis of the facts must force one to the conclusion that they are surgically unwarranted. We should prevent the continuation of such work by the severe criticism and ridicule which such procedures deserve.

CLINIC OF DR. E. WYLLYS ANDREWS

Mercy Hospital

DIVIDED BLOOD-VESSELS AS AIDS TO ACCURATE WOUND CLOSURE

Summary: Importance of accurate adjustment of tissues for rapid, clean wound healing; faulty apposition and faulty repair in the deep layers of the skin and below the skin a cause of broad scars; paired ends of divided vessels the best guides to proper alignment.

Visitors often ask why we tie our arteries in pairs across the wound edges in this clinic. I will explain this surgical wrinkle in detail. It is of more theoretic than practical importance possibly, but we see good in it and use it every day.

You may have noticed that we tie together or reunite the stumps of all our divided veins and arteries across the wound instead of using separate ligatures on each side. When a cut is made through the skin and other layers the bleeding points appear in pairs, each cut vessel having a corresponding cut vessel on the other flap exactly opposite. Of course, these are tied off separately, and the stumps never fall together exactly end to end or knot to knot, as wound closure is usually done, hence the tree-like or arborescent arrangement of blood-vessels is interrupted, and a map of their distribution would show a displacement of the trunk from its branches. It is the purpose of collateral circulation to make up this defect by numerous compensatory branches, and this it does amply and easily in most cases. The work put upon the tissues to accomplish this must be less the nearer the ligated ends are brought together, because the collateral circuits are made shorter. If the cut ends could be united lumen to lumen, no collateral vessels would have to be developed, but they can only be united after being occluded. Hence all we can expect is to shorten the collateral distance around these occluded ends.

If we had microscopic eyes, and could scan minutely the depths of every wound we close, doubtless we would see a very different picture from that in "Billroth's Surgical Pathology," showing a narrow, almost invisible line of separation bridged by buds and loops of new tissue cells and vessels. Instead we would see most wounds to be crossed and inlaid by gaping spaces, concealed only by the neatly fastened skin. The work is coarse and not even macroscopically accurate, as every one knows, large masses of tissue being included in heavy stitches rather than many smaller masses with finer stitches. The coarse suture has the advantage of speed and greater supporting power. Also it is practical and serves our needs. Finer stitching, more layers to be sutured separately, might mean more time, more trauma, less certain and clean healing.

What gain, it might be asked, could come from adding new steps to wound closure if present methods give sound, quick, and permanent repair? One answer would be that our methods are already changing for the better. We do not really know that wounds may not be made to repair themselves faster, more surely and cleanly, and strongly than they do now. In fact, we see individual variations even now. Some are stronger, quicker, and more invisible when healed than others, and we cannot tell why in all cases. Some even now show undue drainage or reaction apart from sepsis. We do know that a steady evolution has gone on, improving the results in all well-known clinics, which makes our wound healing surer and quicker than a decade or two ago.

Wounds heal more kindly and more quickly today because more pains are being taken in wound suturing. No small part of this improvement lies in the care which modern operators give to closure of individual layers of wounds. Where the older surgeons used mass sutures, enclosing many layers in one stitch, the newer technic calls for careful closure of individual structures layer by layer. Now we sew like structures to like, closing an incision tier above tier with separate sutures, and we know it pays for the time and trouble, even though the older methods did give many good results.

Whether it be a joint or other cavity that be opened, or the skull and meninges, or merely the depths of the soft parts, we seek to close up such lesions completely from within outward by sewing muscle to muscle, fascia to fascia, fat to fat, skin to skin, or it may be bone to bone, tendon to tendon, nerve to nerve, and even vessel to vessel. Perhaps the surgeon of the future will even search out the lymph-channels and reconstruct their courses in closing wounds.

Are such ideas impractical and useless? No. The more the care and nicety in adjusting the wound layers, the better our repair; but all this accurate adjustment of wound layers works only in one dimension—the vertical. Why not work in three dimensions? There are two other directions in which wound edges are often deformed or displaced by false suturing—the longitudinal and the transverse. If the elastic skin had permanent transverse marks to guide us, we would find that many wounds after closure were drawn considerably out of line lengthwise or bent or drawn laterally from the original straight or curved line to some other form. That such results in practice may cause no harm we may admit and still claim some advantage for more accurate methods. Our knowledge of tissue repair does not tell us why scars differ so much after complete repair. Some scars are linear and almost invisible as time goes on. Others, apparently as favorable at first, widen out and have broad atrophic ribbons or large weals or welts. We are likely to find the cause of all this in what is out of sight, the faulty repair below the skin or in deep layers of the skin itself. The coarsely sewn skin with gaping spaces beneath may look fair and smooth when first sutured, but will yield the broad, conspicuous scar line. The same incision, with its subcutaneous muscles and fat firmly sewn and its edges everted with *agraffes*, or skin-clips, will yield a scar almost invisibly fine after a year or more.

We know no limit to the perfection of healing which follows minutely accurate closure. To illustrate this, I have several times had to regraft torn off pieces of tissue—usually skin, as a bit of the finger, or, in one case, the tip of the nose. If clean,

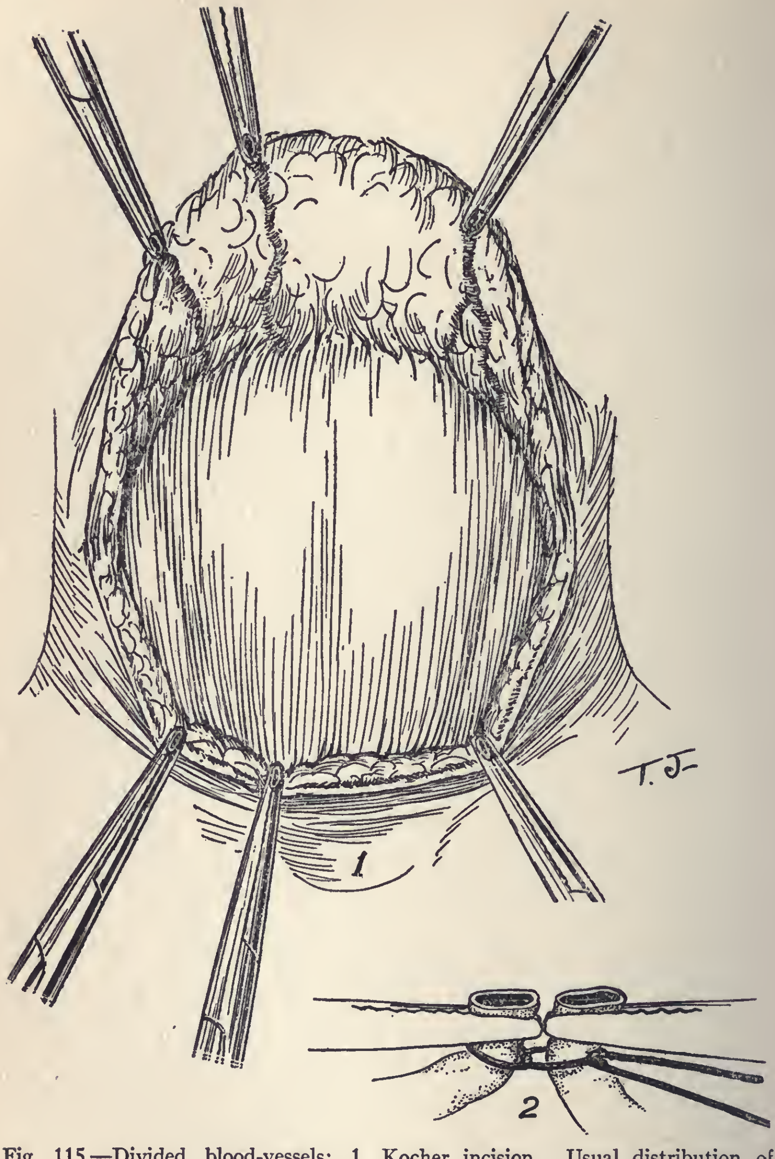

Fig. 115.—Divided blood-vessels: 1, Kocher incision. Usual distribution of superficial vessels. 2, Detail of figure-of-8 connecting ligature.

these fit with an accuracy which no new graft can approach. Such pieces carefully fitted to their old bed commonly unite so

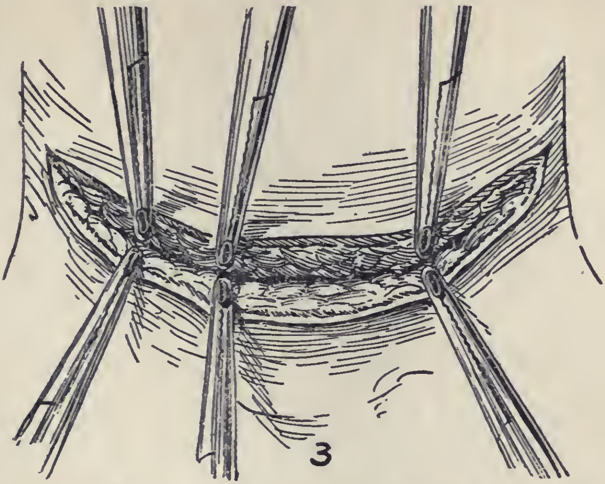

Fig. 115*a*.—Divided blood-vessels: 3, Drawing cut ends of vessels toward each other.

smoothly as to make the line of union nearly invisible. No graft from another part or another patient ever forms such perfect implants.

It is worth while inquiring whether in any wound minute care of adjustment might not show equal benefit. It may be that all cells grow better when placed against their absolute fellows and that all degrees of displacement do harm. Just as an autoplastic transplant grows better than a heteroplastic, so a cut cell may grow better to that from which it was cut than to those only a few centimeters distant. Admitting this, we should find that longitudinal displacement was an injury for vital as well as mechanical reasons. Displacing wound edges longitudinally ever so little changes the relations of nerve filaments and capillary branches enough to put new work on the organism and hinder repair.

Of all means of identifying the exact longitudinal position of wound edges, a study of cut vessels is the surest. The tissues have their ramifying vessels like branches of a tree radiating to central trunks. In outline they resemble the branching of rivers on a map. They furnish fixed points when divided which, like the surveyor's stations on a map, enable us to orient everything else in the field. This is no more true of blood-vessels than of radiating nerve filaments, but vessels are large and must be caught up. When seized and held by forceps they are seen to lie in pairs, each vessel end having its fellow in the opposing flap. Let us take as a practical instance a hernia incision above Poupart's ligament. This divides at a stroke three or more vessels, making about six bleeding points to be seized with hemostatic forceps. When these points are ligated separately and the wound closed, it will be accident that determines whether the opposite cut ends fall near together or several centimeters apart. The soft distensible skin usually stretches so unequally that we never know how much it is deformed. I have sometimes practised marking the skin transversely with cross scratches at regular intervals before making the incision, to furnish an accurate guide in placing the stitches of a suture line. When this guide is used it is surprising to note how it exposes the inaccuracy of our ordinary stitch spacing. It shows us that a longitudinal error equal to the distance of one or two stitches is rather the rule without this guide.

If, however, we use the arborescent vessels just below the skin as a guide, and restore the arbor or tree-like form by connecting each cut branch to its fellow, a perfect wound adjustment is secured automatically. This is true in all three dimensions—the length, breadth, and depth of a wound—for the vessels lie in different planes like other structures.

To illustrate this method in another location, let us describe an ordinary goiter operation. Here the large vessels run vertically or obliquely so as to cross the transverse collar incision in several places, as in Fig. 115; these cut vessels furnish a perfect guide if their opposing stumps are tied each to its fellow, thus preventing any dragging or pulling from inaccurate skin union.

In closing deep cuts in the mesentery, such as made in bowel resection, it is found that vessel ends are a guide and help in accurate adjustment. The same is true of almost all incisions which are to be reunited with stitches. There is hardly an incision known to surgery in which this tendency to show bleeding points in pairs is not seen, and in which this principle of using them for suture guides is not applicable.

CLINIC OF DR. ALBERT E. HALSTEAD

St. Luke's Hospital

THREE CASES ILLUSTRATING POINTS IN THE SURGICAL PATHOLOGY OF THE REGION OF THE EMBRYONIC BRANCHIAL CLEFTS

Summary: Ranula—origin, diagnosis and treatment; technic of the operative cure.

Cyst of the Ductus Thyroglossus—an embryonic remnant; how thyroglossal fistulæ develop after birth; differential diagnosis from dermoids, sebaceous and branchial cysts; treatment.

Retromaxillary Tumor Probably of Branchial Origin—differential diagnosis of tumors of the superior carotid triangle.

CASE I.—RANULA

R. H., aged seven. On admission complained of recurrent sore throat with difficulty in breathing, and at times in swallowing. This is due to a growth underneath the tongue.

About two months ago he began to complain of his throat. His mother looked into his mouth and discovered a growth under the tongue. He has had all the diseases of childhood—measles, whooping-cough, chicken-pox, and scarlet fever.

Examination shows a well-nourished child of seven. Some difficulty in breathing, which does not seem to be due to the moderately enlarged tonsils and adenoids. In the floor of the mouth, occupying the entire sublingual space, there presents a tumor, soft, fluctuating on pressure, and painless. It is of a blue or violet color. There is no pulsation and no diminution in size under pressure. It is somewhat larger than an English walnut. Physical examination of the child is otherwise negative, with the exception of a slight systolic murmur heard at the base of the heart.

Comments.—The term "ranula" has been used since the days of Hippocrates to define tumors of various origin that occupy the sublingual space. Earlier writers, including Hippocrates and Celsus, considered these tumors inflammatory, and many curious theories as to their origin were advanced. I need mention only that of Paré, who believed them to be the result of a "descensus of pituitary matter from the brain." Later, when the salivary glands were better understood, a closer study of them led Jourdin to attribute ranula to a closure of the ducts of the sublingual glands. This was the nearest approach to the true explanation of ranula that had been made up to that time. This view that ranula resulted from the closure of these ducts with a dilatation of the glands behind the obstruction, particularly the ducts of Bartholin or from the same process in Wharton's ducts, has been generally held from the sixteenth century to the present time. No doubt, in some cases, ranula is due to this cause, yet in many cases the tumor bears no relation etiologically to the salivary gland. Of 50 cases from the clinic of Sonneberg, of Berlin, only two were due to an obstruction of the ducts of the submaxillary glands. In one of these the obstruction was from a foreign body. It has also been observed that the congenital atresia of Wharton's duct gives rise to cystic tumors that present on the under surface of the tongue on each side of the frenum. Such a case was operated on by me about fourteen years ago.

Aside from the tumors that have resulted from a more or less complete closure of the ducts of the salivary glands mentioned, we have ranula that are due to a cystic dilatation of the glands of Blaudin and Nuhn. These structures are mucous glands occupying the median portion of the tongue near the apex. They are commonly bilateral, but sometimes only one is found, occasionally extending backward and upward, reaching the base of the tongue. They may also be deep seated, lying between the genioglossus and hyoglossus muscles. If these glands are superficial and anterior the ranula will lie superficial; that is, above the duct of Wharton. If they are deep-seated, the tumor developing from them will be behind the duct and deep in the floor of the mouth. It was Recklinghausen who first described ranula originating from these glands. His first observation was made at an autopsy. He was, therefore, able to make a close anatomic study of the condition as he found it. His conclusion was that the cyst consists of enormously dilated portions of the main intraglandular ducts, and to a secondary glandular hypertrophy accompanied by dilatation of the intraglandular portion of the duct, and a marked inflammatory process within the gland, called by von Recklinghausen "myxangoitis," which in time augments the size of the tumor and plays a considerable rôle in establishing the character of the growth. Sonneberg reported a case similar to that of von Recklinghausen occurring in a child of ten years. In this the tongue was nearly destroyed, the central portion being occupied by large cysts containing mucus and pus.

From the remains of the median portion of tractus thyroglossus—that is, from the tubule or duct of Bochdalek—there develops epithelial cysts that are also classed as ranulæ. These may develop in that portion of the median anlage of the thyroid that is represented by branching ducts or blind pouches lined with columnar epithelium. They may develop between the fibers of the geniohyoglossus and extend from the foramen cecum to the hyoid bone. These cysts growing downward may destroy portions of the tongue, particularly the posterior aspect, terminate in tumors of considerable size which fill the floor of the mouth, or, if the development starts in the lower portion of the tract, they may grow upward into the floor of the mouth, displacing the tongue upward, with the ducts of the submaxillary glands lying above and posterior. If the wall of the cyst is examined before the character of the epithelium is changed by the pressure atrophy they may be recognized by the columnar epithelium that lines the cyst wall. The contents is generally found to be reddish, serous, or mucoid fluid with degenerated epithelium. Infection may occur which gives the contents a mucopurulent character.

Accessory sublingual thyroids undergoing cystic degeneration have been reported as ranulæ. These can be recognized only by the appearance macroscopically and microscopically after removal. They generally originate just above the hyoid bone and grow upward between the geniohyoglossi muscles into the sublingual space. Their contents are generally a clear mucoid fluid or a slightly yellowish gelatinous substance. From what has been said, it is evident that the term "ranula" is a clinical one covering many growths of various origins that may be found on the floor of the mouth, and that it does not designate a distinct pathologic entity.

To recapitulate, ranulæ may be:

1. Cysts due to the obstruction and subsequent dilatation of
    (*a*) Ducts of Ravinius.
    (*b*) Ducts of Bartholin.
    (*c*) Wharton's duct.
2. Cystic growths arising from the glands of Blaudin and Nuhn.
3. Cystic epithelial growths arising from the tractus thyroglossus, generally from the median portion.
4. Cystic accessory thyroids developing above the hyoid bone and growing into the sublingual space.

The symptoms of ranulæ vary with the size of the growth. The small ones may not attract any attention and may be discovered only by accident. As the cyst grows larger the pressure on the lingual nerves may cause pain. In some cases reported the growth rested on both the lingual and hypoglossal nerves, the pressure on the latter causing a paralysis of the lateral half of the tongue. Difficulty in speech develops as the growth increases in size. The hoarse and stridulous character of the voice noted in some cases has been likened to the croaking of a frog. This character of the voice is said to have given the name "ranula" to the growth causing the defect. If the tumor grows to any considerable size and the patient is young, in time an atrophy of the mandible with a deformity of the teeth occurs. These were present in a case recorded by Sonneberg.

Treatment.—The only method of treatment that we need to consider is extirpation. Other procedures that have been advocated are: First, puncture with evacuation of the contents; second, puncture followed by the injection of irritating chemicals with a view to causing an obstruction of the sac; third, incision and evacuation of contents. As the cysts are frequently multilocular, and the contents often thick and viscid, any of these procedures is likely to fail in effecting a cure. Extirpation offers the only assurance of permanent cure. In one case treated by me puncture made by a needle and the use of a bistoury had been tried many times, with recurrence after each attempt. Extirpation, as in the other case I have treated, was successful in effecting a permanent cure. In the majority of cases these cysts can be removed through the mouth. In a few, particularly those cysts that are from the tractus thyroglossus and aberrant thyroids, removal may be best made through a submaxillary incision. Either a lateral or median incision may be employed.

Operation.—The first step in the operation is to introduce a suitable gag to hold the jaws apart. The Whitehead gag is the one we employ. The second step is to pass a linen suture through the tongue, so that it may be pulled forward and upward. You will now see exposed a bluish mass that completely fills the sublingual space and displaces the tongue upward toward the roof of the mouth (Fig. 116). This mass, as you can see, is soft and fluctuating, and projects slightly beyond the lower incisor teeth when the tongue is pulled forward. Palpation with one finger in the mouth and the other hand below the jaw shows that it occupies the entire floor of the mouth, extending backward as far as the hyoid bone. An incision is made through the mucous membrane on the under surface of the tongue and the cyst is carefully separated from the tongue by sharp dissection, care being used to avoid injuring the lingual artery. We are careful not to rupture the cyst. After separation from the tongue, the under surface of the cyst is separated from the underlying structures in the floor of the mouth by dull dissection. We now see that it occupies the space between the geniohyoglossi muscles; these muscles being separated, we see the tumor resting on the geniohyoid muscle, deep in the floor of the mouth. In making the dissection, just before the last attachment of cyst has been separated, the cavity is carefully inspected to see that no portion of the cyst wall is left behind. The cyst is removed by continuing the sharp dissection backward.

Upon removal of the cyst and incising the wall we see it contains a thick gelatinous substance of a yellowish-green color. You will also note that the empty sac, which I present for your inspection, has a very thin and almost transparent wall. From the location of the cyst and the appearance of the cyst wall I would venture to say that this is derived from the dilated intraglandular ducts of the sublingual gland. On careful inspection of the cavity beneath the tongue, after the removal of the cyst, we find no evidences of remaining sublingual glands. After disinfection of the cavity with a weak iodin solution the deeper parts are closed by catgut suture. The cut edge of the mucous membrane along the lateral margins of the tongue is united by suture to the cut edge of the mucous membrane in the floor of

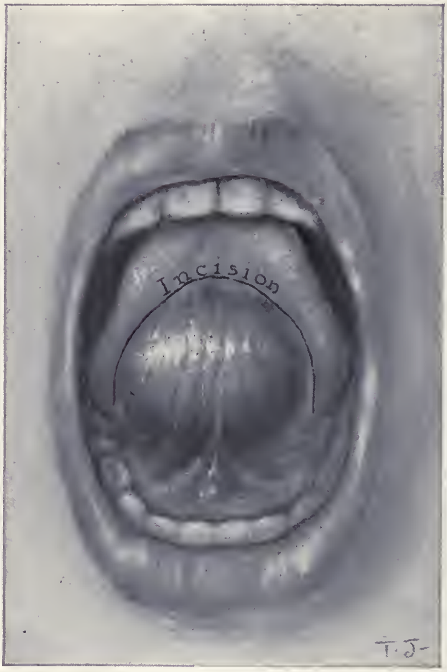

Fig. 116.—Ranula. Note shape of incision.

the mouth. The smaller opening is allowed to remain underneath the lateral margin of the tongue, through which a gauze drain is inserted to the deeper parts of the wound (Fig. 117). The silk suture is now removed from the tongue.

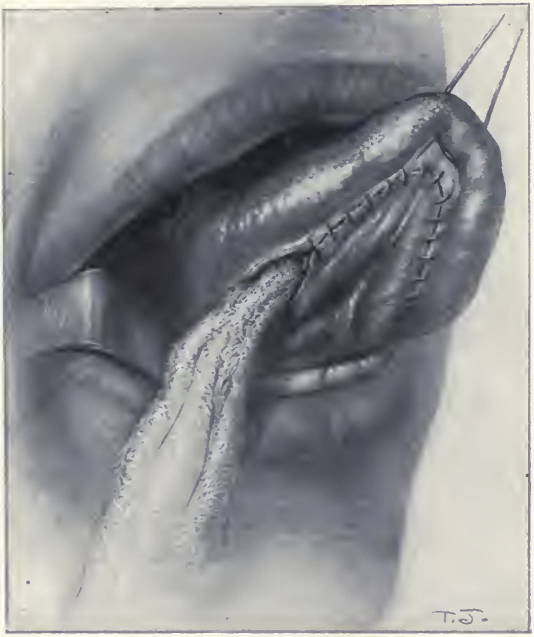

Fig. 117.—Incision closed; gauze drain in place. The tongue is held out during the operation by means of the suture as indicated.

CASE II.—CYST OF THE DUCTUS THYROGLOSSUS

F., male, age forty-nine, enters the hospital complaining of a periodic discharge from a sinus at the root of the neck. The patient says that the sinus has existed since birth, and that his mother has told him that during infancy she often noticed that the milk taken into the mouth would flow from the sinus in the lower part of the neck. During early childhood this sinus closed and remained closed for several years. About twenty-five years ago, when the patient was twenty-four years of age, the sinus reopened and has remained open since that time.

Examination shows a small fistulous opening $\frac{1}{16}$ inch in diameter on the right anterior aspect of the neck, located $\frac{1}{2}$ inch above and 1 inch to the right of the right sternoclavicular joint. There is no pain or discomfort except that due to a slight irritation of the skin about the mouth of the fistula from the discharge and the discomfort incident to the retaining of a dressing to prevent soiling of the linen. The discharge has been continuous for about three years. Previous to this the sinus would remain dry for periods varying from three to six months. The discharge previous to three years ago was thin and seropurulent in character and odorless. Of late it is thick, creamy, and purulent in character, and at times has an offensive odor.

The patient's personal and family history are negative. He has one brother and one sister, both living and well. Neither have any congenitial malformations. He has had the usual diseases of childhood. His venereal history is negative.

Further examination shows a well-nourished and healthy appearing man. The chest, abdomen, and extremities are negative. No defects noted other than the presence of a fistulous opening on the neck, above described. From this fistula there is now discharging a thick, yellow, puriform fluid. This discharge has caused a slight redness of the skin about the fistulous opening. The fistula readily admits an ordinary silver probe for a distance of about 1$\frac{3}{4}$ inches, and the direction seems to be toward the median line. Bacteriologic examination of the purulent fluid shows nothing characteristic. The yellow staphylococcus seems to predominate, although other common forms of pus organisms are present in abundance. The fistulous tract was injected with anilin dye solution. This promptly appeared in the mouth, discharging from a small orifice on the floor of the mouth underneath the lateral border of the tongue, about $\frac{3}{4}$ inch posterior to the incisor tooth. Subsequently the fistula was again injected with bismuth paste. This also appeared in the mouth. Stereoscopic radiograms taken after the injection of the bismuth showed the course of the fistula to be along the inner border of the sternomastoid for about 1$\frac{1}{2}$ inches. It then inclined toward the median line, and above dipped deeper into the neck, passing under the body of the hyoid bone and upward in the floor of the mouth. The portion immediately behind the body of the hyoid bone was expanded into a sac-like dilatation (Fig. 118).

From the location and extent of the fistulous tract it is evident we have to do with one of the median cervical fistulæ of embryonal origin, probably having its origin in the remains of the tractus thyroglossus, the old connecting link between the foramen cecum of the tongue and the isthmus of the thyroid gland. These cysts and fistulæ of the ductus thyroglossus are situated in the median line, usually in relation to the body of the hyoid bone or upper border of the thyroid gland. They are present at birth or make their appearance shortly after birth, or may appear at any subsequent time. They are usually slow of development, but show marked variations in this respect. They are painless, soft swellings. When infection

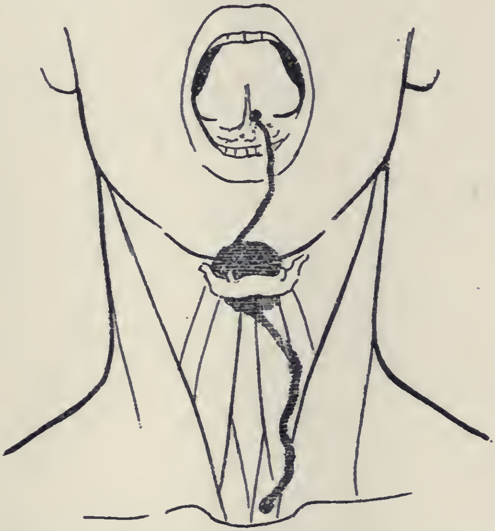

Fig. 118.—Thyroglossal fistula. Sketch made from röntgenograms showing the course of the fistulous tract, and its openings in the suprasternal notch and in the floor of the mouth.

occurs they may take on the characteristics of infected glands or abscesses. They are then generally painful, and as the tension from augmentation of the contents increases they may rupture, with the formation of a discharging fistulous tract, when the infection subsides and the discharge changes from a puriform to a mucous material. In the uninfected cysts and sinuses the discharge is slight. Recurrent infections are likely to continue, increasing the discharge and changing its character from time to time. If the primary infection is acute, or if the infection passes through the cyst wall, an abscess may develop that burrows along the fascial planes of the neck and may break through the skin at most any point between the sternomastoid muscles, either in the median line or, as in this case, close to the sternal attachment of the muscle.

In this case we have to deal with a primary thyroglossal cyst situated above and posterior to the body of the hyoid bone, as you can see from the radiograph. It has probably become infected in early infancy, the infected contents of the cyst undoubtedly burrowing downward behind the sternohyoid muscle and finding its exit near the attachment of this muscle to the upper border of the sternum. In making a diagnosis of thyroglossal cyst we must consider the growths that may appear in this part of the neck.

First: Sequestration dermoids occur here as in the other parts of the middle line of the body. These are recognized by the character of the contents, it being identical with the dermoids of other regions.

Second: Atheromatous cysts or sebaceous cysts. These are in the skin and are never found deeply situated behind the hyoid bone, as are the cysts arising from the tractus thyroglossus.

Third: Branchial cysts. These are found in the regions corresponding to the location of the ductus branchialis and ductus precervicalis of the embryo. These would, therefore, be found along the anterior border of the sternomastoid, generally behind the angle of the jaw. The character of the epithelium lining the cyst wall when examined microscopically will allow us to distinguish between the cysts of the ductus thyroglossus and those of branchial origin. In branchial cysts the squamous epithelium predominates, while in cysts of the tractus thyroglossus we often find columnar or ciliated epithelium. In a branchial cyst wall there are often found masses of lymphoid tissue or small cartilaginous nodules or groups of cartilage cells. These are not found in the cysts arising from the thyroid duct. In the cysts of ductus thyroglossus particles of thyroid tissue may be found in the cyst wall underneath the epithelial lining. Colloid material may also be present which will show the thyroid origin of the growth. In regard to the character of the epithelium it is important to remember that suppuration or prolonged pressure from a distended cyst cavity may alter the epithelium or destroy it completely, so that no diagnostic evidence can be obtained from the examination of one of these old cysts.

Operation.—A transverse incision is made across the neck similar to the collar incision of a thyroidectomy. This extends through the skin and fascia and platysma muscle. A flap of these structures is turned upward, the dissection being carried above the upper border of the hyoid bone. The fistulous tract is exposed lying upon the inner border of the sternomastoid for a short distance. We then see that it runs along the inner border of this muscle to within 1 inch of the hyoid bone, where we find it passes underneath the sternohyoid muscle. An incision of these muscles allows us to expose the tract up to the lower border of the hyoid bone. It passes beneath the hyoid bone, approaching at this point the median line of the neck. Here we find a dilatation of the tract forming a cyst 1¼ inches in length and 1 inch in breadth, extending from the lower border of the hyoid bone backward and upward to the root of the tongue. Above the hyoid bone it rests between the hyoglossi muscles. After dissecting the cyst free, a short channel, ¼ inch in length, with a lumen that admits a small silver probe, is found to pass from the cyst to the floor of the mouth. This is dissected free. The opening through the mucous membrane in the mouth is closed by suture. The cavity occupied by the cyst is packed with gauze. The skin-flap is sutured back with silk. A drain is inserted deep into the wound.

CASE III.—RETROMAXILLARY TUMOR PROBABLY OF BRANCHIAL ORIGIN

Mrs. A., American, forty-eight years old, complains of a tumor on the left side of the neck back of the angle of the jaw. The patient states that she has always noticed a small node underneath the angle of the jaw. She has considered this to be a small gland. Twelve years ago this node began to enlarge. At the same time it became slightly painful to touch. It grew within a year to the size of a filbert. It remained stationary until two years ago. Since then it has slowly increased in size until it has attained at the present time the size of an English walnut. The patient's general condition is good; no additional abnormalities of any kind.

The physical examination is entirely negative except that she is hard of hearing. On the left side of the neck, about 2 cm. below the angle of the jaw, is a hard tumor about the size of an English walnut. This tumor is slightly irregular upon its surface, freely movable and painless, and gives no sensation of fluctuation or pulsation on palpation.

In considering the character and origin of this growth it is well to discuss briefly first the source of tumors common to this region (the superior carotid triangle).

A. Growths connected with the lymphatic system:
  (1) Inflammatory swellings of the lymph-nodes:
    (*a*) Acute:
      Simple adenitis.
      Suppurative lymphadenitis.
    (*b*) Chronic:
      Tuberculous disease of the glands.
      Hodgkin's disease.
  (2) New growths arising from the lymphatic system:
    (*a*) Simple lymphoma.
    (*b*) Lymphosarcoma.
    (*c*) Secondary carcinoma.
  (3) Cysts originating within the lymphatic vessels—lymphangioma cysticum.

B. Growths arising from remains of the branchial system:
- (*a*) Solid branchial epithelial tumors and cysts.
- (*b*) Mixed tumors of branchial origin.
- (*c*) Branchial carcinoma.

C. Tumors of the carotid gland.

D. Tumors of the vascular system.

In differentiating tumors of this region (D) we must consider aneurysms of the external carotid and congenitial blood-cysts. As this tumor is solid we need not take into consideration the cystic tumors of any of the above groups. An acute inflammatory process in the lymph-glands can be excluded upon the history of the slow growth and absence of inflammatory phenomena. Chronic inflammatory diseases of the lymphatics may be excluded on the basis that this growth is single. While it is possible to have but one gland that is palpably enlarged, yet we find upon careful examination in chronic inflammatory processes that the disease involves a group or chain of glands. This is true in syphilis and tuberculosis and also in Hodgkin's disease. The excellent physical condition of this patient will also go a long way in excluding both tuberculosis and Hodgkin's disease. Simple benign lymphoma is rather rare. The tumor is soft and painless and grows rapidly. Malignant lymphoma or sarcoma grows rapidly and quickly involves by extension the surrounding structures, and is associated with rapid deterioration of health and marked anemia. Secondary carcinoma can be excluded by the absence of any primary growth in the region affected. The multilocular cystic character of the tumor in lymphangioma cysticum permits us at once to rule out these growths. The same may be said of the congenital venous cysts originating from the deep veins of this region. Tumors of the carotid gland are rare growths developing from the carotid body, a glandular structure not of branchiogenetic origin, but belonging embryologically to the chromaffin system, being derived from the nerve anlage which pass from the upper cervical sympathetic ganglion. Tumors originating in this gland are at first of slow growth, resembling closely in their clinical appearance those of the branchial system. Later they generally take on a more rapid growth and present the characterictics of malignancy. They are situated at the bifurcation of the carotid artery and are extremely vascular, deriving their blood-supply from both the internal and external carotids and at times from the common carotid. This great vascularity frequently causes that expansile pulsation which closely resembles the pulsation of an aneurysm. They are generally soft, vascular appearing growths, and on cut section show a reddish-gray or reddish-brown color. They form metastases, and like other malignant growths have a great tendency to recur.

The solid tumors or cysts of branchiogenetic origin generally arise from the second cleft or furrow. They are, therefore, found in the region of the ductus branchialis and ductus precervicalis, which structures are present in the embryo and represent stages of growth of the first and secondary branchial arches. As the branchial ducts and precervical sinus are but temporary structures, failure of complete retrogression permits groups of epithelial cells or "rests" to remain buried in the neck. From these epithelial elements the solid tumors originate. Other tissues, such as cartilage or bone, may be derived from the arches (first and second) which go to form the hyoid bone and the mandible. The solid tumors of this region are generally mixed tumors, containing both mesoblastic and hypoblastic elements. The mixed tumors of the parotid gland are of the same structure and origin. Branchial carcinoma represents the malignant degeneration of the solid or cystic epithelial tumors of the branchiogenetic origin. They are also termed "deep carcinoma" in contradistinction to the carcinomata originating from the superficial epithelial structures. The clinical history of these tumors is that of a slow benign process at first. Later they take on a rapid growth involving the deeper structures of the neck and speedily bring about a fatal issue.

Operation.—An incision 3 inches in length is made over the tumor and along the anterior border of the sternomastoid muscle. The skin and fascia are separated, exposing the superior carotid triangle of the neck. The tumor is found encapsulated. Its anterior aspect is in close union with the posterior belly of the digastric muscle. Its posterior surface is intimately connected with the fascia enclosing the carotid vessels. It is removed by sharp dissection. The deeper parts of the wound are closed by catgut suture and the skin is sutured with horsehair and the usual dressing applied.

The tumor which has been removed is nearly spheric, measuring 1¼ inches across on the median section. Its cut surface is grayish red, with areas that glisten like cut cartilage. It is dense and firm and gives a grating sensation on section. We are, therefore, justified in assuming that it contains cartilage and that it is a mixed tumor, probably of branchiogenetic origin.

CLINIC OF DR. MALCOLM L. HARRIS

Alexian Brothers Hospital

LARYNGECTOMY UNDER NERVE BLOCKING

Summary: A patient with extensive carcinoma of the larynx involving extra-laryngeal tissues; radical laryngectomy indicated; technic of nerve blocking for laryngectomy; its superiority over general anesthesia; the novocain-calcium-magnesium solution.

The case which we wish to show this morning presents the following history, omitting unessential details: F. K., age forty-seven. He has been feeling poorly for the past six months, during which time he has complained of a sore throat, cough, and difficulty in swallowing. He has had a mucopurulent sputum, streaked with blood, which has become quite profuse of late. For the past month he has been unable to swallow without great pain, and about three weeks ago he lost his voice, so that now he can speak only in a whisper. His appetite is poor and he has vomited after eating several times recently. He says he has lost about 60 pounds in weight. His general appearance is bad, he is poorly nourished, shows a great loss of weight, and his muscles are flabby. The important part of the physical examination, so far as we are now concerned, relates to the larynx. This is found to be filled with a nodular ulcerated mass. The right vocal cord is entirely destroyed and the left one paralyzed. The mass so fills the larynx as to cause a marked stenosis. There are a few palpable, enlarged, hard lymph-glands on either side, particularly the left, in the upper anterior triangle of the neck.

A diagnosis of advanced carcinoma is unmistakable, but notwithstanding the advanced stage of the disease and the poor general condition of the patient, the stenosis is so marked and the dyspnea so intense that an operation is imperative in order that he may have relief. A simple tracheotomy would give relief so far as the dyspnea is concerned, but we feel that the patient should be given a chance at least for that greater relief which may come from a more radical operation, and this, too, in spite of the fact that a few of the neighboring lymph-glands are already involved. We are also led to the major rather than the minor operation for the further reason that a complete laryngectomy is but little more difficult than a proper tracheotomy. Exception may be taken to this last statement by many who have done laryngectomy by the older method with general anesthesia, and we will agree perfectly with anyone that a complete laryngectomy, done with all the annoyances, difficulties, and dangers of the usual general anesthesia, is a very trying as well as a serious operation, but under nerve blocking the operation is robbed of most of its difficulties and becomes quite simple.

Under nerve blocking the operator is freed from the annoyances inevitably connected with the anesthetist and his apparatus, the tracheotomy tube, etc., and can proceed with the operation with a perfectly free field. The nerve supply of the anterior region of the neck is well adapted to nerve blocking, and almost all operations involving this region can be performed by this method with great satisfaction. To block this region the needle is inserted just behind the middle of the posterior border of the sternomastoid muscle. The external jugular vein usually crosses this muscle at about that point, so that the needle usually enters just above and behind the point of crossing on the vein and the posterior border of the muscle, but the vein varies somewhat at times, so that it alone is not a reliable guide. The vein, however, should be identified before inserting the needle, so as not to puncture it and thus inject the solution into the vein. The point of the needle should lie just beneath the deep fascia in immediate proximity to the branches of the superficial cervical plexus. The needle being now inserted, as shown in Fig. 119, 25 c.c. of the novocain-calcium-magnesium solution[1] are injected on either side

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[1] Solution used:

Novocain, ½ per cent	3 parts.
Calcium chlorid, 2 per cent	1 part.
Magnesium chlorid, 2 per cent	½ “

Mixed at the time of using, and to which about 6 drops of 1 : 1000 adrenalin solution are added, just before using, to 60 c.c. of the solution.

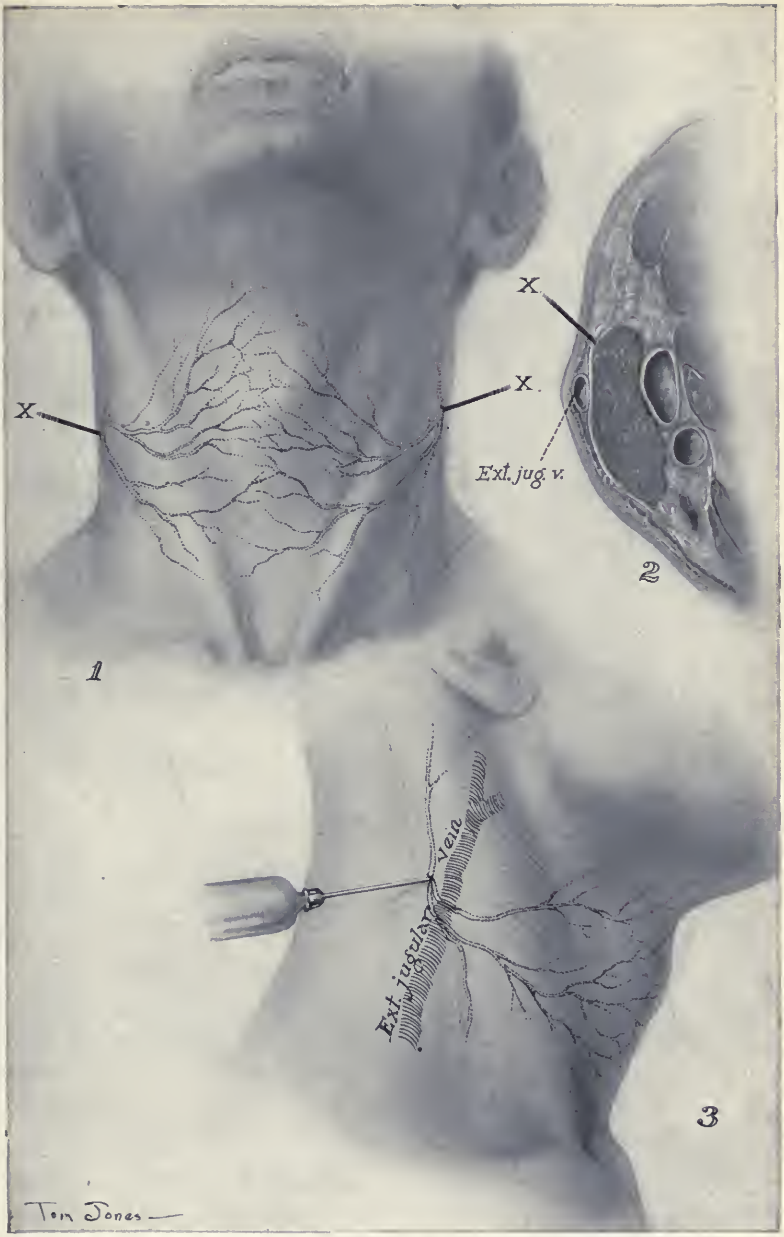


Fig. 119.—1 and 3 show the distribution of the nerve-supply of the neck and the point at which the needle is inserted for the injection of the anesthetic. In 2 the position of the injecting needle and the immediate anatomic relations are shown in cross-section.

of the neck; 10 c.c. of the same solution are next injected on either side, near the outer end of the hyoid bone. In less than five minutes we have a complete anesthesia of the entire region of the neck. An incision is made along the midline of the neck from just above the hyoid bone to the suprasternal notch, and, on account of the enlarged glands on the left side, a transverse incision is made near the upper end parallel with the hyoid bone. The longitudinal incision is carried down at once to the thyroid cartilage above and to the trachea below, exposing the isthmus of the thyroid, which is doubly ligated and divided and the lateral halves pushed aside. A loop of strong silk is passed around one of the cartilaginous rings of the trachea, the trachea completely divided above that ring, and the lower end of the trachea drawn out at the lower angle of the wound. A few drops of the novocain solution are now injected into the mucous membrane of the proximal end of the trachea, and you will notice that there is no evidence of tracheal irritation, no tendency to cough, and no change in the rate or character of the respirations after treating the trachea in this manner. By means of the silk loop about the ring of the trachea the end of the trachea can be easily drawn forward out of the lower end of the wound so there is no interference with respiration. The advantage of not being bothered by the anesthetist at this point of the operation is very apparent. On account of the dissection of the upper anterior triangle of the neck, which we intend to make, we turn down and out skin-flaps at the upper angle of the incision.

We now proceed to dissect out the larynx completely, including the tissues and lymph-glands on either side above. On dissecting posteriorly we reach the region of the esophagus and the pharynx, and up to now you will notice that the patient has given no evidence whatsoever that he has suffered the slightest pain, but on cutting the wall of the pharynx he moves his hand as an indication that it hurts. This we would expect, as we are now in a region not supplied by the cervical plexus, but by the glossopharyngeal nerve, so we will now inject a few drops of novocain solution along the wall of the pharynx so as to block this region. In doing this we should be careful not to block the pneumogastric nerves. Having made this injection, we proceed with the dissection, and the patient gives no further evidence of pain. The larynx is now completely removed, including the epiglottis and the surrounding tissues. Fortunately, we are able to close off the pharynx in front, which we do with catgut. A drain is placed in the upper end of the wound and the skin closed down through the lower angle, where we bring the proximal end of the trachea to the surface and carefully suture it to the skin, leaving the opening free without the introduction of a tracheal tube.

The patient will be placed in bed and allowed to sit up at once, and will be fed for a few days through a tube.

Anyone who has undertaken, or even witnessed, an operation for the complete removal of the larynx under general anesthesia cannot fail to be impressed by the ease and facility with which the operation can be performed under nerve blocking. As you have seen, there has been no difficulty with respiration, no trouble or annoyance with the anesthetic, and the patient's general condition at the end of the operation shows that there has been practically no shock. His pulse was 90 before starting the operation, and it is only 100 now, the quality and fulness remaining about the same. It is quite evident from his actions during the operation that he suffered no pain, and this, too, notwithstanding the fact that he had no morphin, scopolamin, or other anodyne before the operation, showing conclusively that the anesthesia and freedom from pain were due entirely to the nerve blocking.

NOTE.—This patient recovered from the operation, gained rapidly in weight and general health, and was very comfortable for some months, when internal metastases began to show.

CLINIC OF DR. CARL BECK

North Chicago Hospital

PLASTIC OPERATIONS ON THE UPPER EXTREMITY

Summary: Great functional value of the hand and arm—necessity of knowing how to preserve the usefulness of an extremity following an injury. Disability due to cicatrix—treatment.

Four illustrative cases:

Case 1.—A man with marked contractures at the elbow, wrist, and about the thumb following severe burn; technic of the correction of the deformity and the restoration of function.

Case 2.—Loss of thumb and first finger as the result of a crushing injury; repair of the large defect by means of pedunculated skin-flap.

Case 3.—Amputation of thumb for sarcoma; repair of defect; the first finger trained to assume the function of a thumb.

Case 4.—Mobilization of an amputation stump which had been made useless by contracting scar tissue.

The function of the arm and hand for a laboring man is of the highest value. The sacrifice of even the smallest part of it means a great loss; it may mean the loss of a livelihood. Of course, a great deal depends upon the kind of work which the arm performs. The arm of the street laborer with mutilated fingers may still be very useful, but if the same injury were to befall an artist who plays the piano or the violin, it would mean the absolute loss of a career or permanent invalidism. It is, therefore, of the greatest importance for the surgeon to study the methods of conservation and restoration of the arm and hand to usefulness and function.

During the past three years many thousands of individuals have been injured and maimed in the war to such an extent that apparently only useless stumps of their arms are left, but in many instances surgeons are succeeding in making these limbs useful by careful prosthesis and plastic operations. It is, therefore, of the utmost importance to study this part of surgery as much as possible, as there will be many hundreds of instances in which conditions can be improved if the surgeon knows how to go about it.

The first important factor will be for the surgeon to prevent, if possible, the loss of the function by the greatest watchfulness during the treatment after the injury and during the remote after-treatment. He should endeavor to retain the activity of muscle, nerve and blood-supply, and to prevent stiffening of joints, retraction and contracture of muscles, bad scar formation, and atrophy of valuable muscles and tendons. All these preventive features, of course, will be out of the question when the case comes to the surgeon with an accomplished deformity, and the only question which will arise then will be, What can be done to make this arm or hand useful? It will be interesting to study a few cases of plastic restoration of arms, hands, and fingers of which I shall show you a few examples.

A little more than a year ago this man, John F., a foreman for the Commonwealth Edison Co., while working at a station grasped a 2000-volt free-end of a connection, and immediately his hand, arm, shoulder, and the side of his chest were burned to a black crust. He was brought to the hospital in a very shocked condition. Fortunately for him, the current seemed to have invaded the tissues only to such an extent that the deeper structures, like tendon, muscle, nerve, and blood-vessel, were not destroyed except in very small places. The skin, however, and the subcutaneous tissue and fat were burned.

The immediate treatment consisted of such dressings of the wounds as were the least painful for him and the most promising for future repair. Sloughing took place, as it usually does in such cases, and gradually a large surface of the forearm, the chest, and shoulder was transformed into granulations. Convalescence was slow. The arm was drawn toward the chest, the elbow was flexed, and the hand bent and stiff in extreme flexion. For weeks he was dressed with salves and powders until the granulations were healthy enough to start skin-grafting. This, however, was very unsatisfactory. The grafts healed only on some places. Figure 120 shows the extent of this injury when all these burned surfaces had been transformed into granulations.

Skin-grafts from different individuals were used on different occasions, but the results, on the whole, have been unsatisfactory except in some places where no motion is required. These places are, for instance, on the outer surface of the arm over the deltoid. Scar would be here just as good, so that the gain through the skin-graft was very small. The granulations gradually, in the course of about a year, contracted in the elbow and over the wrist. The circulation was not particularly good. If the patient held the arm down the hand would appear very cyanotic. The condition at this time is best shown in Figs. 121, 122. These pictures, however, show that there is no contracture in the shoulder-joint, because we have been preventing this by manipulations and by keeping up the motion in that joint. Had we kept this shoulder quiet during the whole after-treatment, there would be a contracture from inactivity and a great deal of difficulty in later use of the shoulder. As it was, with all the contractures in the elbow,

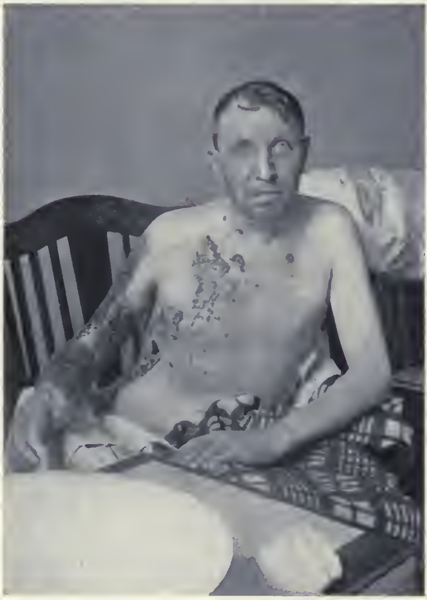


Fig. 120.—Mr. F. Condition after burnt surfaces of hand and chest sloughed off, showing the extent of granulations over the whole arm, forearm, chest, and side of the chest before any plastic was undertaken.

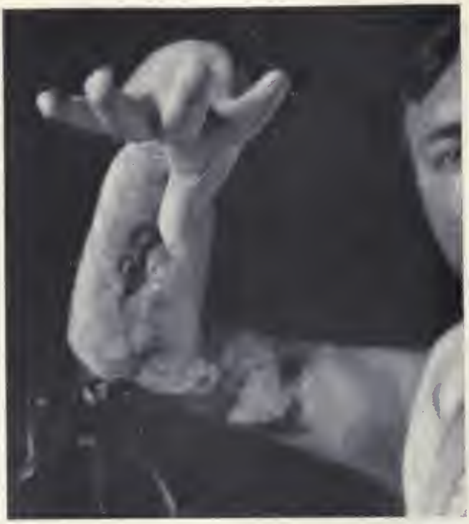


Fig. 121.—The same arm after repeated attempts at skin-grafting. There are granulations on the forearm still present. The elbow, especially above, is very much constricted through granulations and scars and the whole hand is flexed to its extreme by contraction of scar tissue.

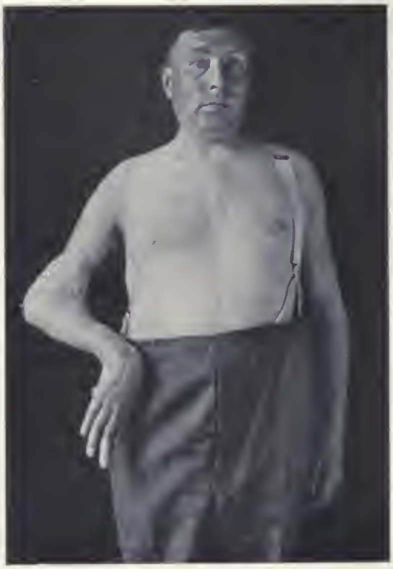


Fig. 122.—All granulation tissue has disappeared and is replaced by scar, showing the extent of contraction—an absolutely useless arm in this condition before any plastic was undertaken.

in the wrist, and in the thumb, as one of the pictures shows very clearly, we have good motion in the shoulder-joint. After the whole surface had been transformed into a good scar, a web of scar was formed between the upper and lower arm, producing marked contracture at the elbow and wrist. We began then to move the contracted joints, and we were able to satisfy ourselves that the contraction was due only to the external difficulty produced by the scar, and not through the stiffness of the joint or destructuion of any muscles. We therefore began to plan a plastic by flap operation.

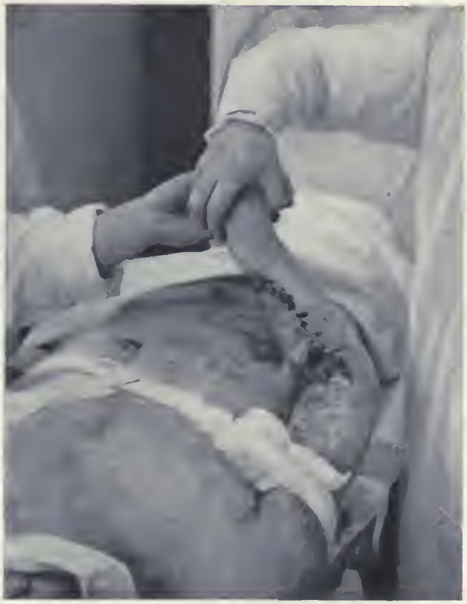


Fig. 123.—The first flap was taken from the chest and attached to the freshened surface over the inner side of the elbow. Adhesive plaster was attached to the upper part of the arm to help maintain immobilization.

The first flap operation is shown in Fig. 123, which is the reproduction of a photograph taken during the operation. When we removed the scar of the elbow and stretched the arm to a perfect horizontal, we found that all the muscles and tendons were intact, but the skin was missing over an area 14 inches in length and about 3 inches in width. This required a very large flap, and it had to be a flap including the whole thickness of the skin, since a Thiersch graft would not allow any mobility of the joint.

The mere presence of an epithelial graft produces more rapid formation of scar. It seems to me that it acts like the adhesive plaster which is sometimes put on a granulating surface, the only exception being that occasionally the skin-graft is cut very thick, and then, of course, we really have not a skin-graft, but a skin-flap with underlying structures, which is essentially a skin-flap without a pedicle. We decided to take a pedicled flap from the chest, as the accompanying Fig. 123 shows. We sutured the flap so that there was no possibility of disturbance of circulation—*i. e.*, with the free tongue of the flap toward the wrist—and we fastened the arm tightly to the chest, so that it was immovable. We also fastened the hand to the body with adhesive plaster. It was a pleasure to see that this flap healed

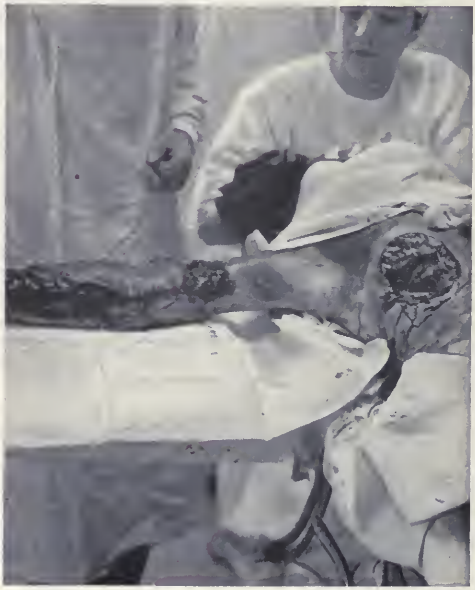


Fig. 124.—Two weeks later the flap was cut free from the chest and the arm fully extended. The oval defect on the chest shows the size of the flap, which in reality is more elongated than is indicated by the shape of the defect.

in place to a large extent, and when we cut its pedicle about ten days afterward (Fig. 124) the large flap was held very correctly over the elbow-joint. Only a little portion of it had sloughed, but about 10 or 12 inches in length and fully 3 inches in width was retained. The large defect on the chest was reduced by drawing the edges together with silver wire and plate suture (Fig. 125).

The next step was to remove the contracture of the wrist. This was more difficult, since the tendons at the wrist had been deprived of their sheaths and were involved in the scar. When we started to operate on the wrist we found that the scar was very dense, and when we removed it we had exposed the tendons of the flexor muscles and had to remove some very large veins. Fortunately, we did not strike any arteries in our dissection. A good-sized surface needed to be covered, and in Fig. 126 we see distinctly how this was done, the hand being sutured to a pedunculated flap over the hip. Some difficulty was experienced with the thumb, which had been adducted considerably, as shown in Fig. 121. This adduction made it rather hard to bring the flap

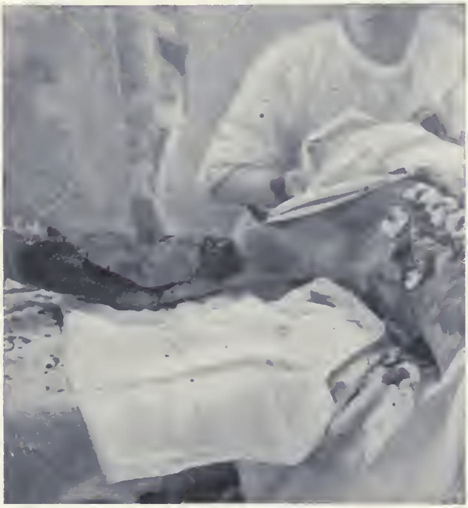


Fig. 125.—The chest defect has been coapted by three wire plate sutures and transformed into a linear wound.

into close contact with the wounded surface, but after we had dissected the thumb away from the hand we were able to get the contact desired. The flap from the side of the hip healed in beautifully, and after a few weeks we had the pleasure of demonstrating the condition shown in Fig. 127. At this time the patient was able to move his arm, as shown in Figs. 127, 128, and 129, flexing and extending it, the only difficulty being that of having the thumb closely adherent. Some time later, however, we started to make also a plastic of the thumb in such a manner that we interposed a flap between the thumb and the first finger, and now, after about a year, the man has a total restoration of his function, being able to use his arm for every part of his work almost as satisfactorily as before the injury.

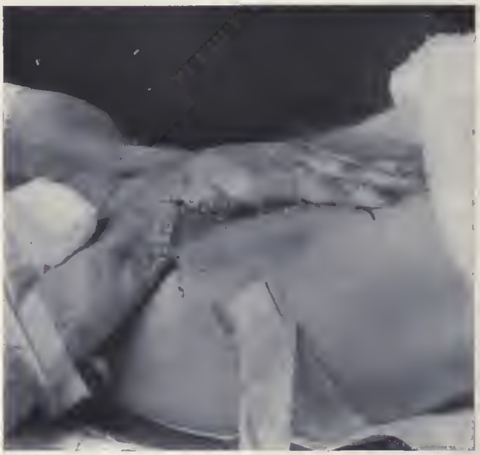
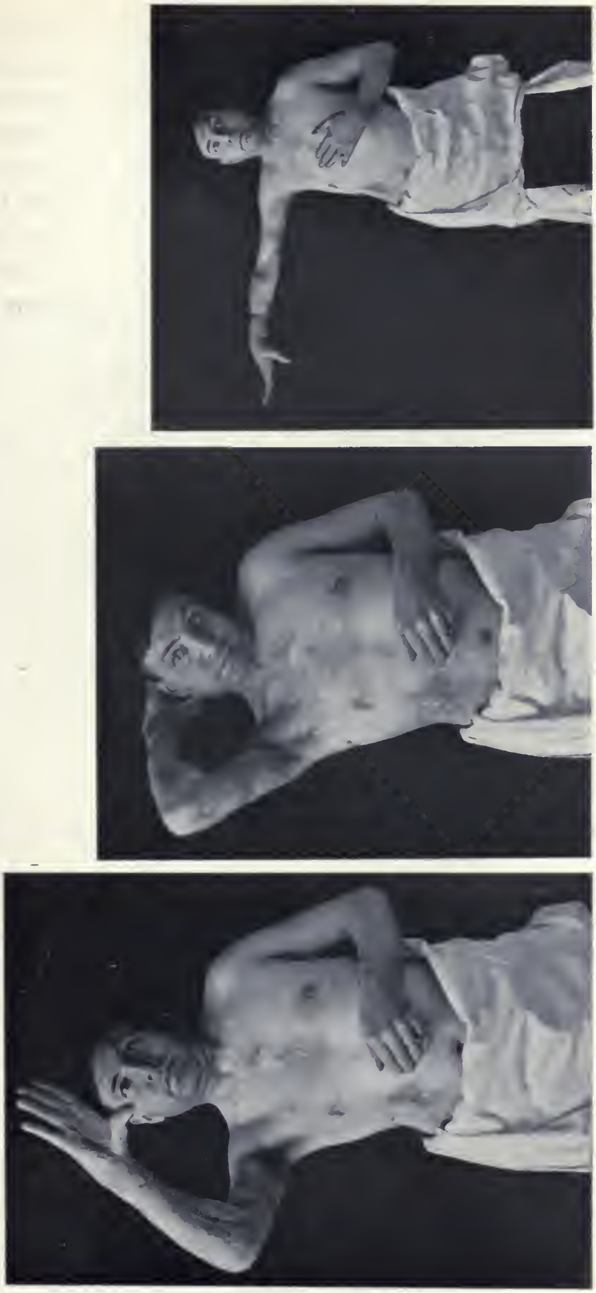


Fig. 126.—The flap for the wrist portion, showing how it is attached to one side of the granulating wound and left in broad contact with the surface to be covered; also the adhesive plaster which kept the arm in position. This picture was taken just before removing the stitches and cutting the pedicle of the flap.

In the last case the hand itself was not injured to such an extent that a part of the same would be lost. We have had cases in which the hand, and particularly the thumb part of the hand, had been injured so that the remaining portion of the hand would be useless unless the injury could be repaired by some tissue that would prevent contracture and allow motion of the



Figs. 127–129.—Illustrating the range of motion obtained by means of the plastic operations. Note the small size of the scar on the abdomen.

uninvolved portion. Figures 130, 131, and 132 are illustrative of such cases. In the first instance (Fig. 130) the man sustained an injury which destroyed his thumb and forefinger. There was a ragged and bleeding wound from which the metacarpal bones were sticking out. A skin-graft of this was impossible, but by suturing flaps from the chest wall over the defect a very satisfactory covering was obtained (Fig. 131).

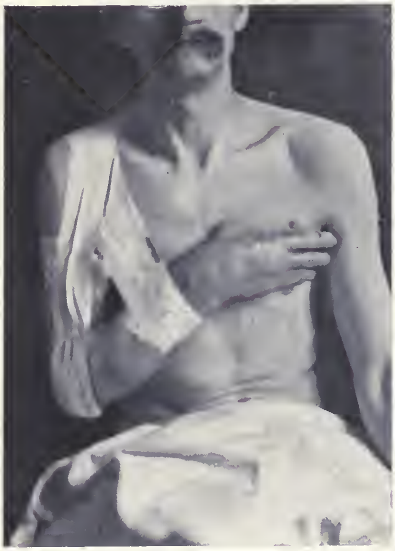


Fig. 130.—The position of the arm, and the flap which was taken to cover a portion of the hand still in contact with the chest wall.

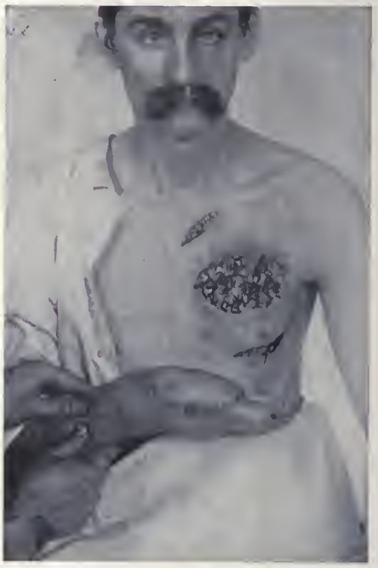


Fig. 131.—The flap attached to the hand on all sides, and the chest defect produced. Two incisions have been made, one on each side of the wound, for the purpose of mobilizing the skin so that the main defect may be closed by linear suture.

I have often been able in such cases to cause the first finger to assume the function of a thumb by gradually getting this finger opposed to the other fingers and so allowing the patient to have a grip. Figure 132 shows a case of sarcoma of the hand which necessitated an amputation of the thumb. That made it very awkward for the man, who is a working man. In order to

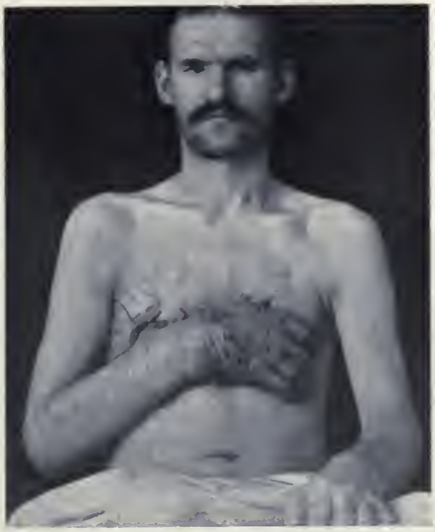


Fig. 132.—The same type of operation as that shown in Fig. 131. A pedicled flap from the chest is being used to cover a large surface left after removal of the thumb for sarcoma.

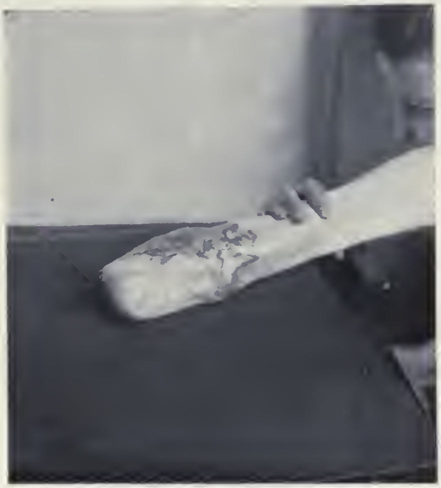


Fig. 133.—The stump of the child's arm after some of the stump has been covered by scar. Some granulations are still present.

satisfactorily transform the first finger into a thumb I was obliged to make a plastic as shown in Fig. 132, which is almost identical with the plastic in the case before, except that in this instance the first finger is retained, so that the man has four fingers instead of three. The first finger is then gradually trained so that it may be opposed to the others, and thus the man becomes able to grasp things with his hand.

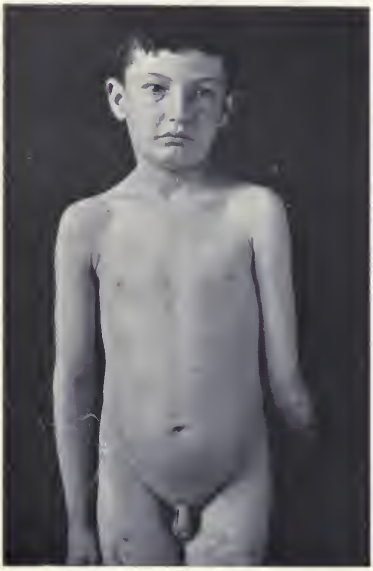


Fig. 134.—Showing how, through the contraction of the granulations shown in Fig. 133, the arm has been so hyperextended that the stump points backward. This is a perfectly useless stump, which would, if an artificial arm were placed on it, make the arm point about forty degrees backward.

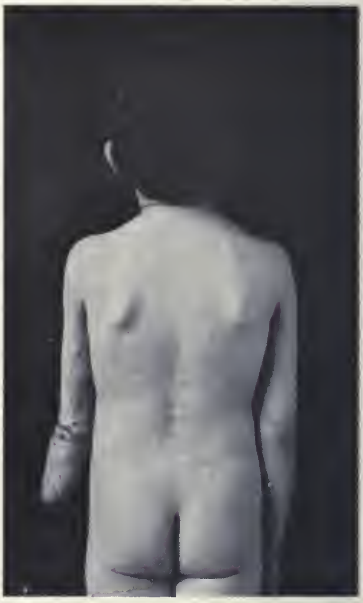


Fig. 135.—The arm from the back. The stump is also clearly visible pointing backward.

An interesting plastic is one in which I restored the activity of a stump after amputation, and which allows this boy to use an artificial hand instead of an artificial arm. The history of this case is very interesting, and the result shows a very satisfactory condition at the present time.

This little boy was run over by a street car. He was taken to a hospital, where a primary amputation was performed. Very carefully the doctor retained everything that was possible, but, unfortunately, there was not enough skin to cover the stump of the forearm. The amputation of the forearm was done in such a manner that about 3 to 4 inches of the radius and ulna were retained. There was not enough skin present to cover the stump below the elbow. On two different occasions I tried to skin-graft this surface, as it looked very healthy, but on both occasions most of the skin-grafts sloughed off and would not heal. There was too much suppuration. Gradually, however, the scar drew the skin over the elbow-joint, and, some of the skin in front of the arm having been retained, it covered the stump, as is shown to some extent in Fig. 133. By secondary skin-grafts and adhesive plaster dressing we ultimately got a scar to cover the whole stump, with the result, however, that the arm was absolutely immovable at the elbow-joint and the stump was drawn backward in hyper-extension, as is shown in Figs. 134 and 135. This made it very

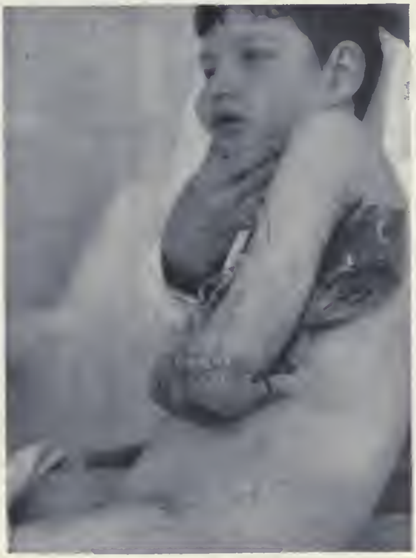


Fig. 136.—The method which has been used to allow flexion, by breaking the elbow-joint which is partly stiff, and attaching a flap with the pedicle to the chest.

awkward for the boy in using an artificial hand. He could not flex the stump, and there appeared to be nothing to do except to cut off the arm somewhere above the elbow, so as to give the boy

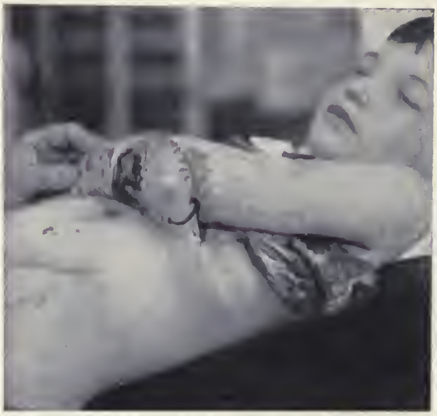


Fig. 137.—The pedicle has been partly severed and the incision is about to be completed.

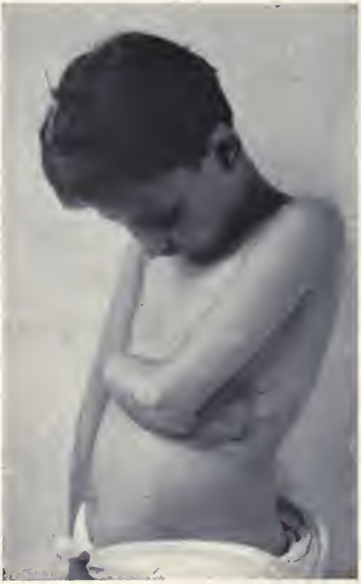


Fig. 138.—The end result. The flap healed in place and the patient rapidly acquired the normal range of motion.

a better stump for an artificial arm. I decided, however, to make every possible effort to save the stump and mobilize the elbow-joint, because if this could be accomplished the range of usefulness of an artificial hand would be greatly increased. The way I did this is shown in Figs. 136 and 137. A pedicled flap was taken from the chest. The ankylosis at the joint was broken forcibly under anesthesia, the stump flexed, and the skin defect which existed here was dissected clear down to the muscles and then covered in the manner indicated. I sutured the arm to the chest, and to prevent the boy from tearing it off also bound arm and chest with adhesive plaster.

The result was very good, as the picture (Fig. 138) shows. The flap healed in and was later separated from the chest, and now the boy has complete mobility of his forearm, so that all he misses is his hand, which, of course, is a great advantage over a stump stiff at the elbow, and over a stump such as would result from amputation above the elbow-joint.

These three cases are illustrative of a method of plastic repair of defects by the use of large pedicled flaps from the chest, breast, and side of the body, which has a great field of usefulness and should be familiar to every surgeon.

CLINIC OF DR. ALLEN B. KANAVEL

Wesley Hospital

BULLET LOCATED BETWEEN THE ATLAS AND THE BASE OF THE SKULL: TECHNIC OF REMOVAL THROUGH THE MOUTH

Summary: Indications for the removal of foreign bodies from the tissues; case history; operation indicated because of the severe pain; method of exposing the vault of the pharynx; the bullet located at operation by means of the fluoroscope; uneventful recovery.

The case here presented is of especial interest because of the symptoms presented through the unusual location of the bullet, and, second, because of the technic used in its removal. The removal of a bullet or foreign body is, of course, not necessary unless it impairs the function of the individual or jeopardizes his life. In the present case operation was delayed for nearly two months in the hope that after the primary irritation had subsided it would cease to give signs, but this hope was not justified, and its removal became imperative.

It was approached with some timidity because of the complex relation of the structures in juxtaposition to the bullet, since it was feared that not alone would it be difficult to remove, but that a meningeal infection might ensue and jeopardize the life of the patient.

CASE REPORT

G. M., aged eleven years, referred by Dr. J. S. Cunningham, of Gibson City, Illinois. The patient was shot eight weeks before the date of the operation by a 22-caliber bullet. The bullet entered to the left of the median line on a level with the cricoid cartilage, and passed upward and to the right and lodged between the atlas and the base of the skull, lying upon the dura. The bullet, as shown at operation, had grooved the atlas in its course (Fig. 139). No vital structures were injured in the passage of the bullet.

After the primary inflammation had subsided the patient complained of constant dull pain in the right side of the neck, below the mandible. This was so severe as to disturb his sleep and to give him constant pain when awake. He made the further complaint that movements of the head laterally did not give much pain, but that movements anteroposteriorly caused such severe pain that he was unable to execute them. His physical condition was excellent. There was no evidence of any other complicating condition.

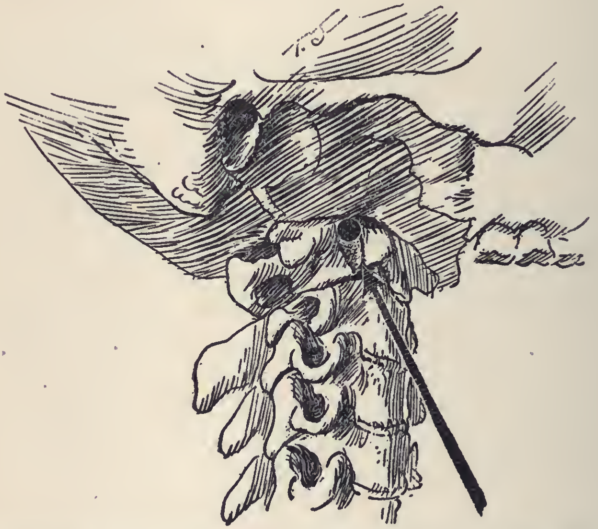


Fig. 139.—Location of the bullet between the atlas and the base of the skull. Note the groove on the atlas. The arrow indicates the course of the bullet.

He was watched for eight weeks in the hope that the irritation would subside, but, on the contrary, it seemed rather to grow worse, and it was deemed necessary to make an attempt to remove the bullet. Both lateral and anteroposterior x-ray pictures and stereoscopic pictures were taken that located the bullet accurately about ½ inch to the right of the median line on the anterior surface of the dura, between the atlas and the base of the skull.

The only absolutely clear picture that was procured was an anteroposterior picture with the head thrown back and the mouth widely open.

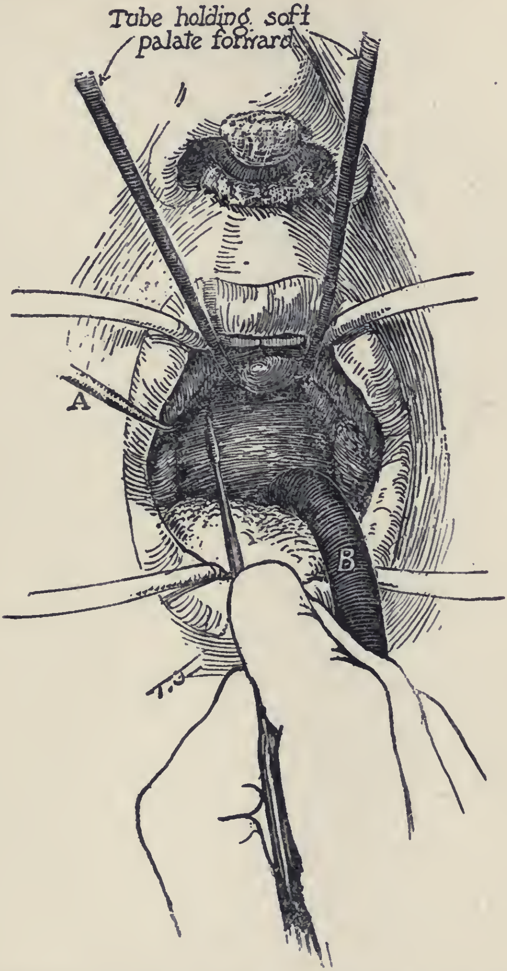


Fig. 140.—Technic of removal. Tube inserted in nose with gauze, which protected the septum from pressure, the posterior pillar on the right side being hooked up and drawn forward.

It was recognized that it was impossible to remove the bullet by a lateral incision. The patient was, therefore, anesthetized and the head thrown far back, and a rubber tube introduced through the nostrils, with the two ends brought out through the mouth, so that the soft palate was held up and away from the field, thus exposing the vault of the pharynx (Fig. 140). The anesthetic was given by the pharyngeal method.

An incision about 1 inch in length was then made to the right of the median line, just behind and parallel to the posterior pillar on the right side and on a line with the atlas. With a blunt dissector the muscular and connective tissues were separated down to the body of the bone, and the groove which had been cut by the bullet was identified, but the bullet could not be seen. A silver wire was, therefore, placed through the tissues at that site and passed deeply, and the patient taken to the fluoroscopic room, where it was evident that the wire was immediately over the bullet. He was then returned to the operating-room and further search made. It was then found that the bullet had formed a pocket behind the upper part of the atlas, so that sometimes it would lie between the atlas and the base of the skull and at other times it would lie in the pocket on the inside of the atlas (Fig. 141). The bullet was found at a depth of at least 3½ cm. from the mucous membrane surface. It was then removed and the wound painted with tincture of iodin, and a small strip of gauze was packed into the wound, no suturing being done.

The patient made an uneventful recovery, with the exception that his temperature ran up as high as 102° F. on the third day and his nose and face were somewhat swollen, due probably as much to traumatism as to infection, since there was no evidence of severe inflammation. This immediatley subsided. The gauze was removed at the end of twenty-four hours. The patient left the hospital at the end of ten days. He could at that time flex and extend the head without pain, an action which had previously been impossible. A late letter from him states that he has no evidence whatever of the previous injury.

The removal of the bullet from this position and by this route, while unique and seemingly rather difficult, really presented no

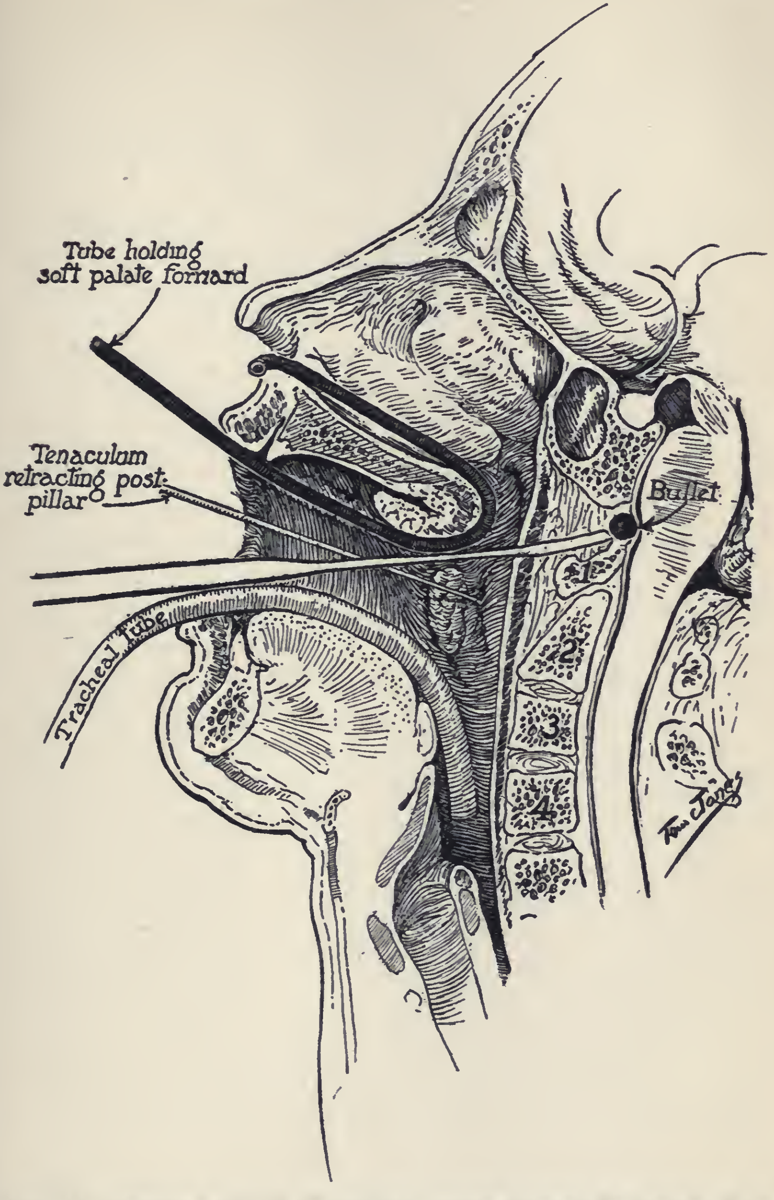

Tube holding soft palate forward
Tenaculum retracting post. pillar
Bullet
Tracheal Tube
1
2
3
4
Tom Jones

Fig. 141.—Sagittal section of the vertebral column showing the position of the bullet.

great technical difficulties. It was somewhat tedious, but there was no hemorrhage and no vital structures were met with. Aside from the possibility of meningitis, rather remote it would seem, the method is without danger, and can be recommended for the removal of such foreign bodies in this portion of the pharynx over the first four cervical vertebræ. The possibility of infection of the wound is, of course, present, but with adequate drainage probably need not be feared.

CLINIC OF DR. D. N. EISENDRATH

MICHAEL REESE HOSPITAL

INGUINOSUPERFICIAL HERNIA ASSOCIATED WITH NON-DESCENT OF THE TESTIS

Summary: A patient seventeen years of age with a soft, spheric mass in the left inguinal region, and but one testicle, the right, in the scrotum; undescended testis—indications for operation; non-descent and abnormal descent; interstitial herniæ—types; technic of operative procedure in present case.

THE history of this case presents nothing unusual. The patient is a boy of seventeen who was examined by a physician for one of the large corporations, who discovered an undescended testis on the left side and advised patient to be operated on. Neither the patient nor his parents were aware of the condition before this examination. The left side of the scrotum is empty, the right side contains an apparently normal testis. In the left inguinal region is a round, soft mass about two-thirds the size of the right testis, which lies immediately beneath the skin, just over the left inguinal canal. There is no impulse on coughing, and traction upon the tumor does not enable one to bring it down into the scrotum. This last test is, in my opinion, a very important one in considering the advisability of operation in general, in cases of non-descent of the testis. Formerly it was my custom to advise parents to wait until the age of puberty before operating for a non-descent. Gradually I lowered this age, so that in the past few years I have made it my practice to advise operation as early as the third or fourth year if traction upon the testis lying either in the inguinal canal itself or just external to it does not enable one to bring the testis readily down to the lower end of the scrotum. One sees many cases in children in which the inguinal canal is weak, and the testis at the first inspection is found lying at the bottom of the scrotum and then by the action of the cremasters is drawn up into the inguinal canal. These are not cases for operation, as in the majority the testis will ultimately descend and remain in the scrotum.

When one makes traction through the intact skin upon a high-lying testis, and is only able to push it down to the level of the external ring, I do not believe that much is gained by waiting, and knowing as we do, from the work of Uffreduzzi, that only in about 10 per cent. of the cases does normal spermatogenesis take place in cases of non-descent of the testis, it is better to advise early operation. Eccles, in his book on "Non-descent of the Testis," calls attention to the fact that the development of the testis in cases of imperfect descent is more and more imperfect as one approaches puberty, and this, to my mind, is another argument in favor of early operation.

The case which I show today impresses us before operation as being one of the variety where the testis has been arrested in its descent in the second or inguinal position. I only wish to recall a few general facts in connection with non-descent in order that you may understand this particular case.

It is necessary to distinguish clinically between an arrest of the testis in its normal course and a deviation from such a normal direction. Under the former heading the testis may be arrested in: (*a*) the iliac fossa (abdominal retention or arrest), (*b*) the inguinal canal (inguinal retention or arrest), and (*c*) retention just beyond the external ring (upper scrotal type of arrest). Under deviation from a normal direction we speak of a pubic, femoral, or perineal testis, according to the abnormal position to which the testis has been withdrawn by one of the four tails of the gubernaculum.[1] Almost invariably a non-descent or abnormal descent of the testis is accompanied by a hernia, which descends along the inguinal canal into the scrotum in the former class, and does not differ in its anatomy or contents from those of an ordinary inguinal hernia of the indirect variety. In the cases of abnormal descent (femoral, pubic, or perineal testis) the sac accompanies the testis to its aberrant position. In connection with the cases of arrest of the testis in its normal course we have a special variety of hernia to which the name "interstitial" has been given. There are of this latter form three locations in which the sac may be found: The first and most frequent is one in which the sac is found between the internal and external oblique abdominal muscles and is continuous with the main sac in the inguinal canal. The second variety of interstitial hernia is where the sac lies or has extended up between the external oblique aponeurosis and the skin overlying the inguinal region. The third variety is commonly called a "properitoneal hernia," the sac being found between the peritoneum and the transversalis fascia. There are several peculiarities of these interstitial herniæ of which it is necessary to speak: namely, that the sac may often be of an hour-glass form, one-half extending in an upward direction between the layers of the abdominal wall and the other in a downward direction toward the scrotum. Not every case of interstitial hernia is associated with non-descent of the testes, because the condition may be found in the female. Coley (Annals of Surgery, 1909) shows a number of illustrations of such interstitial herniæ in the female, in one of which strangulation occurred. In the case we are to operate today my diagnosis is that of non-descent with associated interstitial hernia, on account of the superficial position of the testis, apparently external to and lying upon the inguinal canal.

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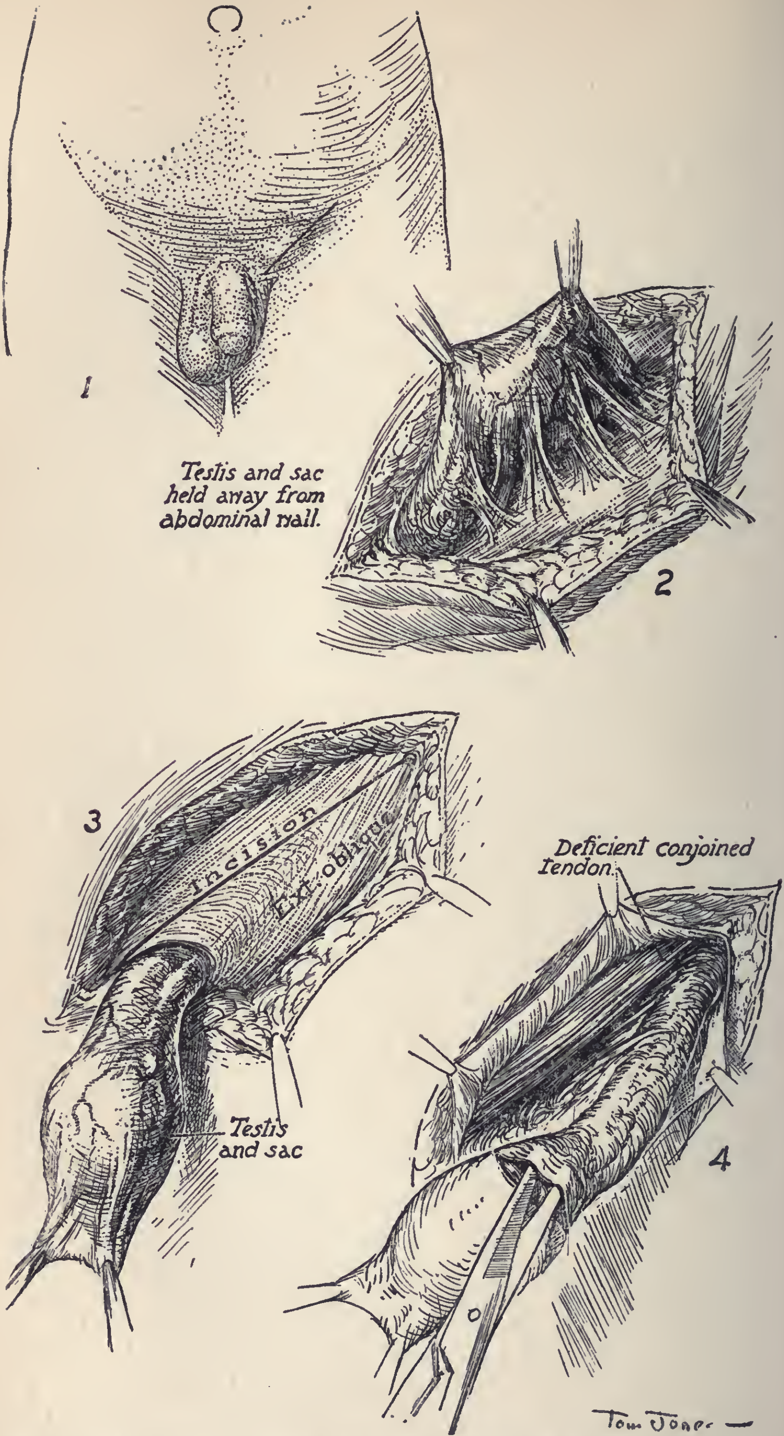
[1] For further information in this direction the reader is referred to a recent article by the author in Annals of Surgery, September, 1916.

OPERATION

Incision from spine of pubis (Fig. 142, 1) to a point a little above the middle of Poupart's ligament. Upon dividing the skin and subcutaneous fat the testis and a fairly large hernial sac is found lying upon and intimately connected by many fibrous bands with the aponeurosis of the external oblique muscle (Fig. 142, 2). Upon separating these the testis and sac can be traced down to the external abdominal ring, the sac itself continuing up into the inguinal canal to the internal ring. Upon opening the inguinal canal in order to follow the sac upward I desire to call your attention to what I consider to be one of the most important causes not only of inguinal herniæ in general, but of arrests of


1
Testis and sac held away from abdominal wall.
2
3
Incision
Ext. oblique
Deficient conjoined tendon.
Testis and sac
4
Tom Jones

Figs. 142, 143.—Technic of repair of inguinosuperficial hernia associated with non-descent of the testis.

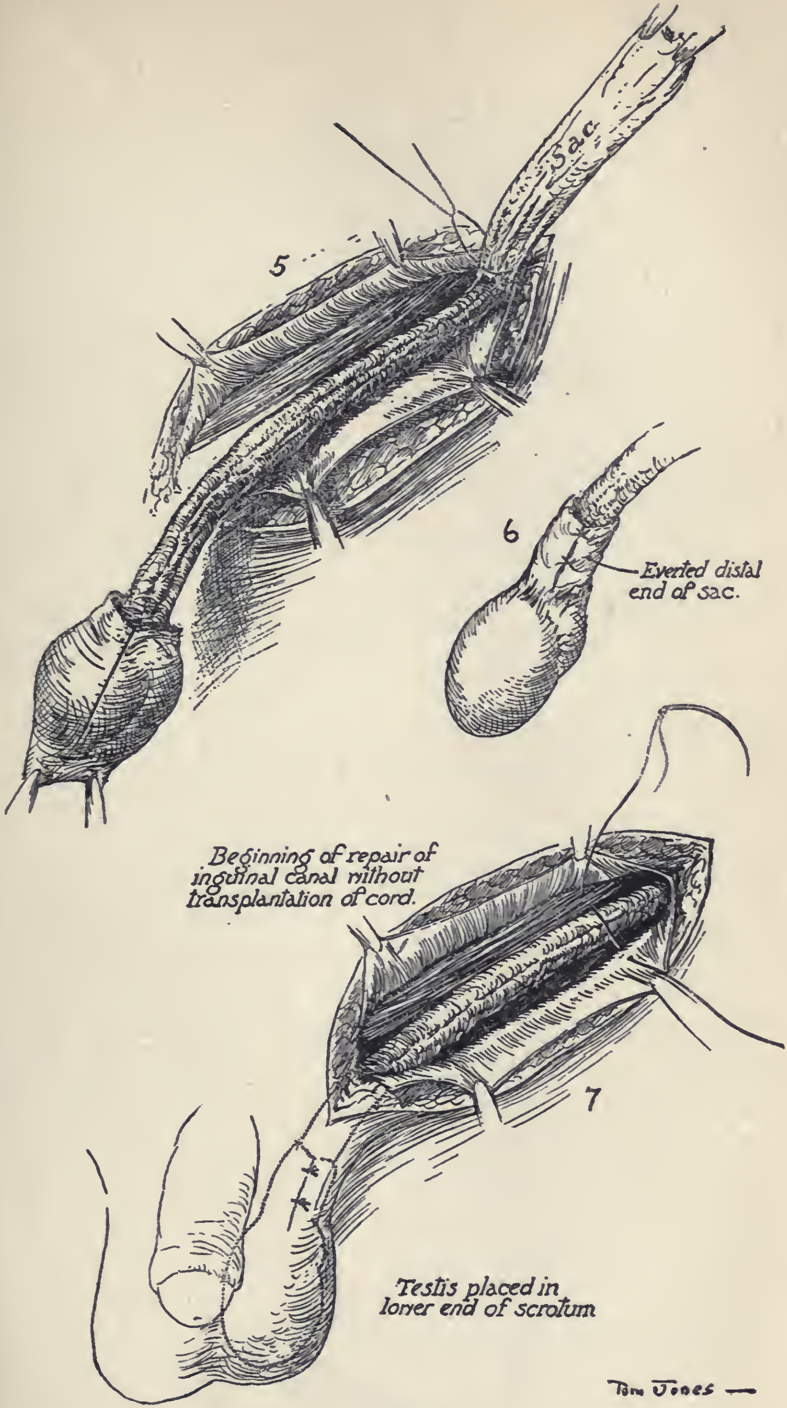

Sac
5
6
Everted distal end of sac.
Beginning of repair of inguinal canal without transplantation of cord.
7
Testis placed in lower end of scrotum
Tom Jones

Fig. 143.

descent of the testis, namely, the lack of development of the internal oblique and conjoined tendon, which fail to act in their normal capacity as a sphincter in the inguinal region (Fig. 142, 3).

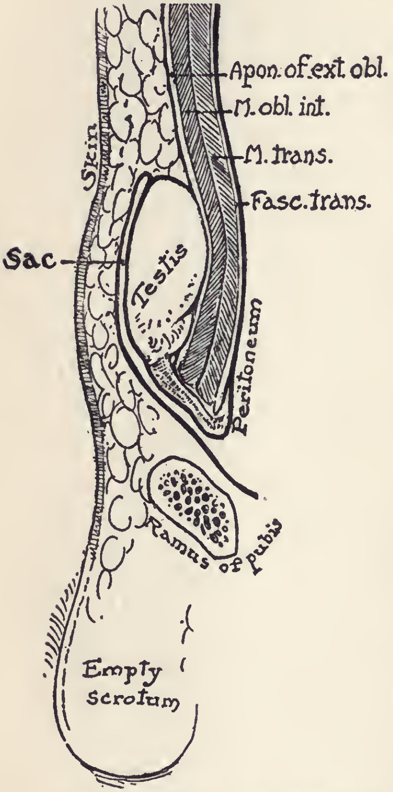


Fig. 144.—Case of inguinosuperficial hernia, the sac and testis lying between the external oblique aponeurosis and the skin. The sac is of the hour-glass form, one-half lying in the inguinal canal with the constriction at the external ring, and the other half with the testis lying between the skin and external oblique aponeurosis.

Upon freeing the testis from the external oblique aponeurosis and the sac as far as the internal ring, the next step is to separate the vas and its vessels in the most careful manner from the posterior surface of the sac. I desire to call your attention to the necessity of employing very small instruments in separating these structures from the sac, of which they seem to form a portion. If the sac is rotated and traction made upon its lower end, the vas and vessels can be seen lying much farther apart than they do in the adult. This is important to know, since the beginner will often miss isolating the main spermatic veins on account of the distance which they lie away from the vas deferens. When the sac is fairly thick, as in this case, the separation of the structures of the cord is a comparatively easy task, but when it is extremely thin the utmost care must be exercised in the separation. After this step has been accomplished the sac is divided transversely (Fig. 142, 4) close to the testis. Then, while the sac is grasped with an artery forceps, a finger covered with a piece of gauze is employed to separate the vessels, which are the chief source of difficulty in bringing down the testis from the sac. This point is one of the most important to which Dr. A. D. Bevan has called attention, and, as he so frequently states, if one can secure complete separation of the vessels high up it is scarcely ever necessary either to resect the veins or to resort to any such expedient as ligating the deep epigastric vessels or passing the testis to the inner side of them in cases of non-descent. I prefer not to ligate the proximal end of the sac until this high separation (Fig. 143, 5) has been completed. The distal end of the sac is everted around the testis and lowermost end of the cord with fine catgut sutures in order to prevent the occurrence of a postoperative hydrocele. The testis is held by an assistant at the lower end of the scrotum, while a purse-string suture, as first suggested by Dr. Bevan, is inserted at the level of the external ring in order to prevent the testis from pulling up into the canal. This suture can be inserted without any danger of pressure upon the structures of the cord. The inguinal canal is repaired by Andrews' modification of the Bassini method without transplantation of the cord. In children I close the skin with a chromic catgut suture, and apply a cast extending from the level of the umbilicus across the inguinal region to the middle of the thigh. This not only prevents soiling of the dressings by urine, but enables one to get the child out of bed upon the day following the operation.

In this case we have an example of the second most frequent variety of interstitial hernia, namely, the inguinosuperficial type, in which the testis and the sac lie between the external oblique aponeurosis and the skin (Fig. 144).

CLINIC OF DR. CARL B. DAVIS

Rush Medical College

SUPPURATIVE PERICARDITIS—DEMONSTRATION OF A CASE ONE YEAR AFTER OPERATION

Summary: A boy with multiple suppurating foci culminating in an attack of suppurative pericarditis which healed as the result of operation; diagnosis of suppurative pericarditis; aspiration for diagnostic purposes dangerous and unnecessary; technic of drainage of pericardium; diagnosis of adhesive pericarditis; its influence in the prognosis of the present case; general features of suppurative pericarditis.

November 17, 1916.

One year ago this patient, a boy of ten, entered the hospital with a diagnosis of osteomyelitis of the fifth metatarsal of the left foot, of the left tibia, and the left humerus. The metatarsal lesion had been exposed before the boy entered the hospital. The tibia and humerus were opened and drained. Later the right fibula, the lower end of the left femur, the upper end of the right femur, and right radius became involved, and these lesions were likewise opened and drained. Following each operative procedure the child showed improvement for a time, and then slipped back with a high temperature and pulse and an increased leukocyte count. One month after admission it was noticed the temperature and pulse remained high even though the bone lesions were open and draining. The white count increased to 20,000, there were slight cyanosis, some respiratory distress, and general discomfort about the chest. Examination showed temperature 101° F., pulse 136, respirations 40. The eyes reacted normally to light and accommodation; ears, normal hearing, no discharge, no tenderness over mastoid processes; tonsils negative; several decomposed teeth. Chest: lungs clear, pleural cavities contained no free fluid. The heart dulness extended from the left axillary line to a point $1\frac{1}{2}$ inches to the right of the sternum. The upper margin of dulness extended into the second interspace. The apex-beat was not palpable. The abdomen contained no free fluid. The liver margin was 1 inch above the anterosuperior iliac spine. *x*-Ray examination showed the heart and pericardial shadow as pictured in Fig. 145.

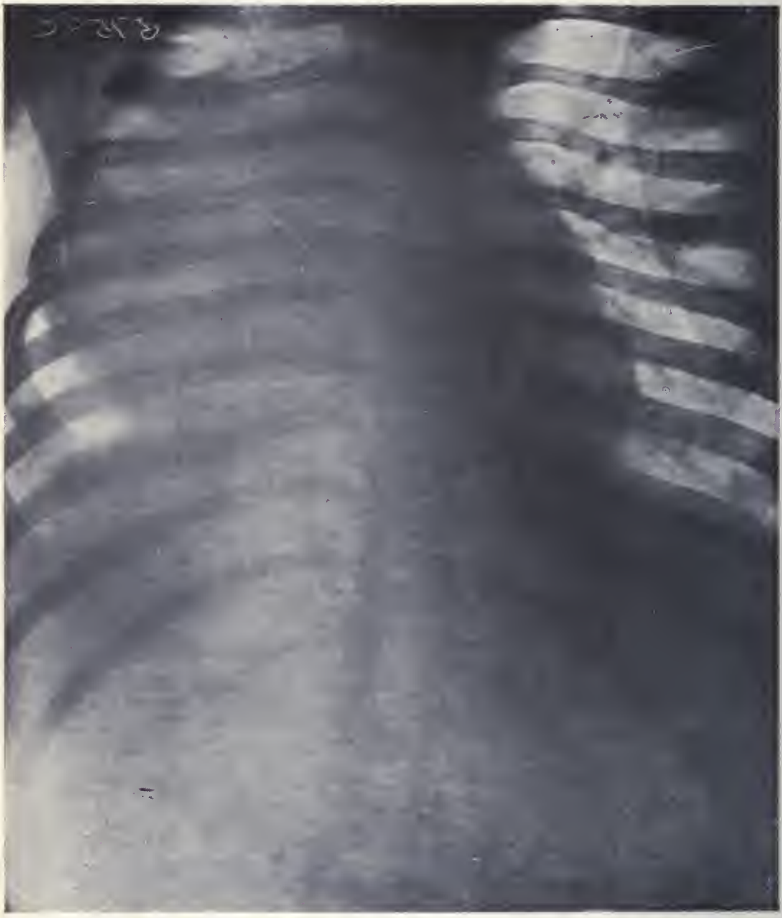


Fig. 145.—Suppurative pericarditis before drainage of the pericardium. Note the ballooning out of the pericardium, especially about the base of the heart; it appears to occupy nearly one-half of the thoracic cavity.

Because of the temperature and pulse, the high leukocyte count, the cyanosis, the heart area verified by *x*-ray, the displaced liver, and the presence of an infection the diagnosis of purulent pericarditis was made. There was no irregularity of pulse or pain in arms. Because of the danger of puncturing and infecting the left pleural cavity it did not seem wise to use an exploratory needle to confirm the diagnosis until operation was permitted by the parents. Under ether a needle was passed close to the sternum in the fifth intercostal space. Pus was obtained. The fourth and fifth costal cartilages were resected for an inch, the internal mammary vessels secured, the left pleura pushed outward, and the pericardium exposed. An artery forceps was

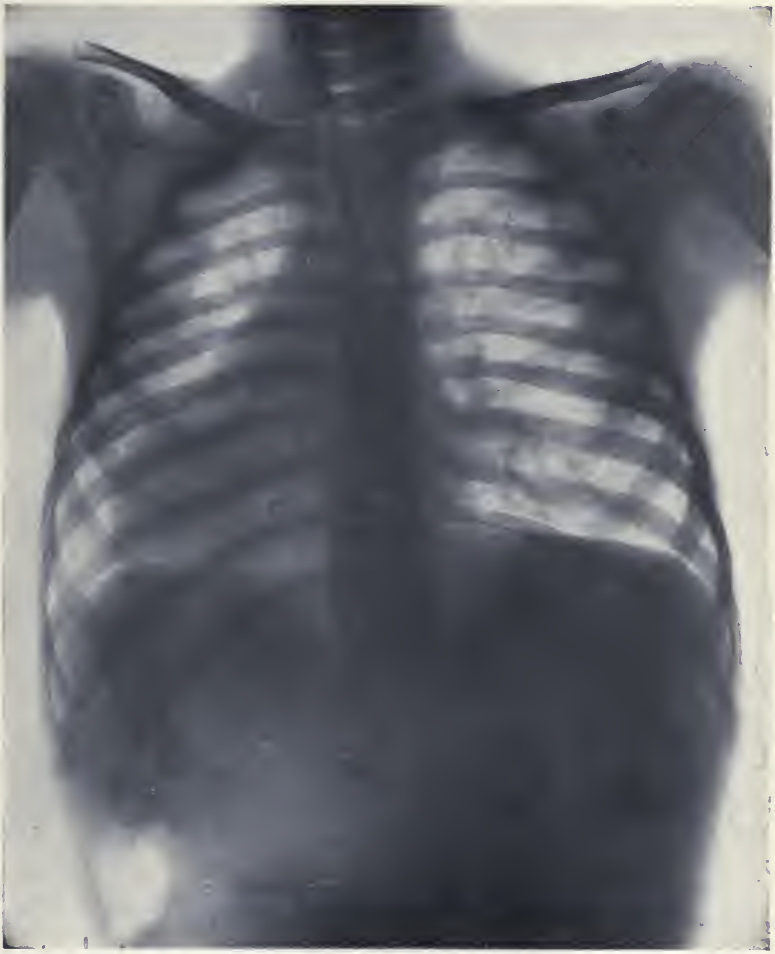


Fig. 146.—Suppurative pericarditis one year after cure by drainage. Compare the relative size of the heart shadow here with that in Fig. 145.

forced into the pericardial cavity by the side of the exploratory needle. A large quantity of pus was allowed to escape slowly. A soft-rubber tube was sutured in the pericardial cavity. Drainage continued for several weeks. The pericardial shadow diminished as was shown by *x*-ray examinations, the liver returned to its normal position, the cyanosis and dyspnea disappeared, and the pericardial wound healed in about four weeks. Bacteriologic examination showed pure cultures of Staphylococcus aureus in all lesions. The parents took the child from the hospital before his treatment was completed.

x-Ray examination today, November 17, 1916, one year after the pericardial drainage, shows the heart boundaries as indicated in Fig. 146. The child is attending school regularly and is in about the same condition of nutrition as his brothers and sisters. He is not very strong, tires readily on exertion, but says he feels good.

Upon physical examination we find a slender small boy. The *head* is negative.

Neck.—Normal contour, arteries fill in normal manner, no abnormal pulsations, the veins are not distended.

Chest.—Scar in fourth and fifth interspaces just left of left sternal border.

Systolic retraction of precordial region except in the apex region, where a positive apex pulsation is seen 10 cm. from the midsternal line, *i. e.*, just inside the line of the left nipple.

Broadbent's sign is noted in the left posterior, inferior, and lateral thoracic region.

Relative cardiac dulness—left border shows a mitral configuration, right border not demonstrable. Absolute cardiac dulness—normal area, but no obliteration on deep inspiration.

Lungs.—Inspection and palpation negative. Percussion—hyperresonant throughout upper borders, symmetric, and normal. Lower borders—right, excursion 4 cm.; left, no excursion.

Auscultation negative.

Abdomen, spleen, and liver—normal dulness and normal position, abdomen otherwise negative.

Extremities.—Evidence of disease in left humerus and right radius. Scars of former lesions present.

Here, then, are definite evidences of this boy's past illness and a foreshadowing of the trouble which we feel is in store for him as its result. You have observed the systolic retraction of the precordial region, the systolic tug laterally and posteriorly (Broadbent's sign), the failure of the absolute cardiac dulness to be affected on deep inspiration, and the absence of excursion of the lower border of the left lung. All this means but one thing, namely, that we are dealing now with a case of adhesive pericarditis; and not only is the pericardium adherent to the heart, but it also is involved in a chronic mediastinitis and fusion of the pericardium with the pleura and to the chest walls. I am demonstrating this case to you because it not only is a very good example of acute suppurative pericarditis successfully treated, in so far as the immediate lesion was concerned, but it also presents so beautifully the typical postoperative results which show us why the ultimate prognosis is so unfavorable, especially in children. Fischer reports that few cases pass beyond the age of puberty. The adhesion of the visceral and parietal layers of the pericardium to one another, and the adhesion of the outer layer of the sac to the other mediastinal structures, to the sternum and to the spinal column result in interference of normal development of the heart and loss of the patient from exhaustion. Treatment is problematic. Rehn advises longitudinal splitting of the sternum to permit of the readjustment of the heart and neighboring structures lying beneath the sternum.

What about the relation of the clinical findings and course of the acute disease in this boy as compared with the general run of cases? I shall mention, briefly, the more important points:

The development of the pericardial distention to the limit of elasticity of the sac with the resultant cardiac depression was quite evident in our case. Rehn has described this condition as "Herzdruck," and Rose as "Herztamponade." It is produced when the extra-auricular pressure of the fluid equals or exceeds the intra-auricular pressure. The symptoms are cyanosis, respiratory distress, precordial pain, and a feeling of oppression in the chest. Pain and swelling of the arms and marked irregularity of the pulse have been described, but were not present in our case.

In the majority of cases the heart has been described as in an anterior position held forward against the pericardium by the exudate. In our patient there was fluid between the heart and anterior pericardium, as was shown by the exploratory needle and by the tip of the forceps which were passed into the pericardial sac.

Aspiration of the pericardium for treatment or diagnosis is not advisable because of the danger of infecting the pleural cavity. Fevrier reports 9 cases treated by aspiration alone, with a mortality of 100 per cent. The position of the right border of the left pleura is so variable that no accurate idea of its relations to the pericardium is possible.

The prognosis of untreated cases or cases handled by aspiration is almost nothing. The mortality following direct incision of the pericardium is between 45 and 50 per cent. There are two chief routes of approach. The first is: Resection of the fourth or fifth or both the costal cartilages and exposure of the pericardium by pushing outward the left pleura. A second method is that described by Mintz. An incision is made parallel with the under border of the seventh costal cartilage. The cartilage is resected, exposing at once the pericardium without danger of injury to the pleura.

Free continuous drainage must be obtained or the purpose of the resection is lost. Irrigation has been advised. We did not use it in our case, as it did not seem indicated. The child improved rapidly with drainage, which was continuous and gradually diminishing. Drainage material has varied. One case of death due to a rubber tube with pressure necrosis of the heart wall has been reported. Gutta-percha strips have been advocated. In our case we used a small-caliber soft-rubber tube.

The literature of operative interference in suppurative pericarditis has been reviewed recently in The Annals of Surgery (1915, lxii, p. 660) by C. B. Rhodes, who was able to gather 86 cases. He does not include paracentesis under operative treatment. Rhode's article is complete, with bibliography, and I should recommend it to any of you who might desire to study this subject more exhaustively.

CLINIC OF DR. D. B. PHEMISTER

Presbyterian Hospital

CHRONIC LUNG ABSCESS WITH PULMONARY HYPERTROPHIC OSTEO-ARTHROPATHY

Summary: History and physical examination illustrative of the essential points in the diagnosis of lung abscess; cause and characteristics of pulmonary hypertrophic osteo-arthropathy; investigation of bacteriologic factors in present case; experimental results; operative treatment of lung abscess—results; objections to insertion of drainage-tubes in chest above level of the seventh rib posteriorly; the Friedrich operation for lung abscess and bronchial fistula; disappearance of the bone changes as the lung abscess healed.

October 19, 1916.

This man is thirty-two years old and a teamster by occupation. He has always been well until about one and one-half years ago, when, while working, he was taken with pain in the right side of the chest, which did not lay him up, but which was fairly severe. It continued and was followed by some cough, but the cough was associated with very little expectoration. He continued to work with the pain in his right side and the small amount of cough for about two months. During this time he lost some in strength and weight and had a little fever. At the end of two months he grew worse, began coughing severely, and expectorating a large amount of purulent material. He had to stop work and began running a temperature and losing more in strength and weight. He went into a hospital at that time and was examined and told that he had some process on the right side of the chest. They did not state whether it was a tuberculosis of the lung or a lung abscess, but he stayed there for a number of months and continued to run a temperature and expectorate foul-smelling material.

Numerous sputum examinations were made and no tubercle bacilli were found. He left that hospital in about three months and later went to another hospital, where he stayed for about two months. There repeated sputum examinations failed to reveal tubercle bacilli. Upon leaving that hospital he went out to the county institution for the tuberculous at Oak Forest, where he continued very much the same. The reports from Oak Forest, which I have seen, state that no tubercle bacilli were found in the sputum. During this entire period he ran a temperature ranging from 100° to 101° F. most of the time. He felt badly and was unable to work. He lost 48 pounds in weight.

In July, while at Oak Forest, he had some pains in the arms and legs, and particularly about the knee-, ankle-, elbow-, and wrist-joints. He says that the pains lasted for a week or so and gradually subsided. There was some edema about the ankles at the time. Since then he has had no symptoms referable to his extremities.

He came to the Surgical Clinic at Rush Medical College August 14, 1916. At that time he was complaining of more or less pain in the right side, weakness, and profuse expectoration of foul-smelling material. Upon physical examination he was found to be in a marked state of emaciation with a somewhat hectic appearance. He was coughing up a profuse and extremely fetid discharge, amounting to four or five sputum cupfuls in twenty-four hours. The extremities were emaciated and there was marked clubbing of his fingers and toes with extreme curvature of the nails. There was noticeable enlargement of the ends of the bones of the forearms and legs. There was no cyanosis of the extremities at that time and there never had been. Physical examination of the chest showed evidences of marked involvement of the middle portion of the right lung. There was dulness which extended from the third to the eighth ribs posteriorly and from the second to the fifth ribs anteriorly. Vocal fremitus and breath sounds were diminished over this area. Breathing was high pitched and very feeble. In addition, there were signs of an obliteration of the pleural cavity on the right side, with absence of respiratory excursion at any of the lung borders.

Here is the *x*-ray picture of his chest at that time (Fig. 147). You see a very heavy shadow in the region of the dulness; it has an uneven outline and is of much the same density throughout. We do not see any cavity containing fluid and air and a fluid level, as we occasionally see in an abscess communicating with a bronchus. If you have an abscess containing air and fluid, the fluid will settle and there will be a sharp horizontal line separating the two. (Compare with Fig. 148.) The density of this shadow is due to the very extensive induration of the abscess wall, which is indicative of its long standing. A recent abscess would have little induration of its walls.

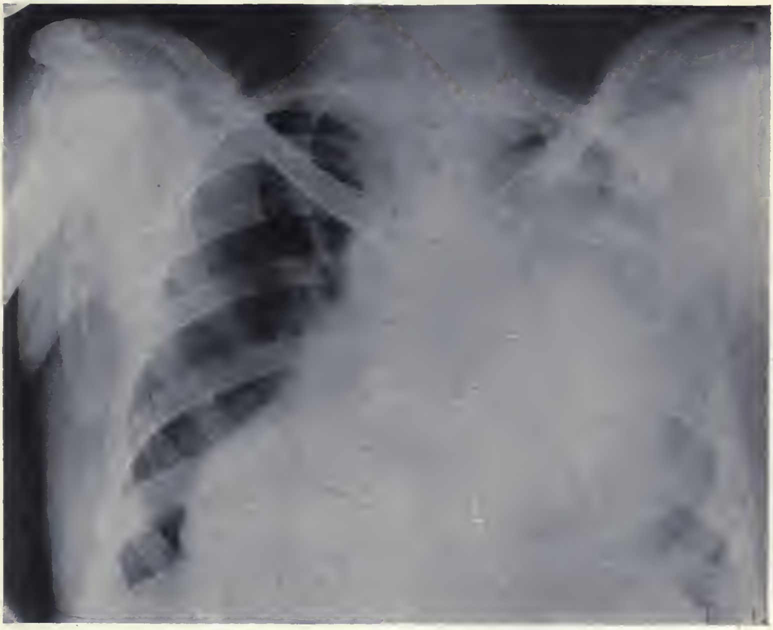


Fig. 147.—Röntgenogram of lung abscess of sixteen months' standing.

The patient was kept under observation in the ward for one week. During this time he ran a temperature from 99° F. in the morning to 100° and 102° F. in the afternoon. We made repeated sputum examinations and could not find any tubercle bacilli.

From the duration of this process, the large amount of foul expectoration, the continued absence of tubercle bacilli, the obliteration of the pleural cavity, and hence the absence of fluid therein, and the dense sharply localized lesion as disclosed by the *x*-ray we came to the conclusion that we were dealing with a chronic lung abscess.

Here are the *x*-ray plates of the extremities which show unusual bony changes. You see a layer of periosteal bony thickening along the shafts of the tibia, fibula, radius, ulna, and of the metacarpals and metatarsus. In the forearm and leg bones this thickening is most marked at the distal ends. There is some thickening also at the lower end of the femur, but none of the humerus. The phalanges, both of the hands and feet, show no bony changes, not even in the distal ones, the clubbing being due entirely to thickening of the soft parts. There are no changes in any of the joints. This condition is commonly known by the name of hypertrophic pulmonary osteo-arthroplasty (Figs. 149 and 150), which was given to it by Pierre Marie.

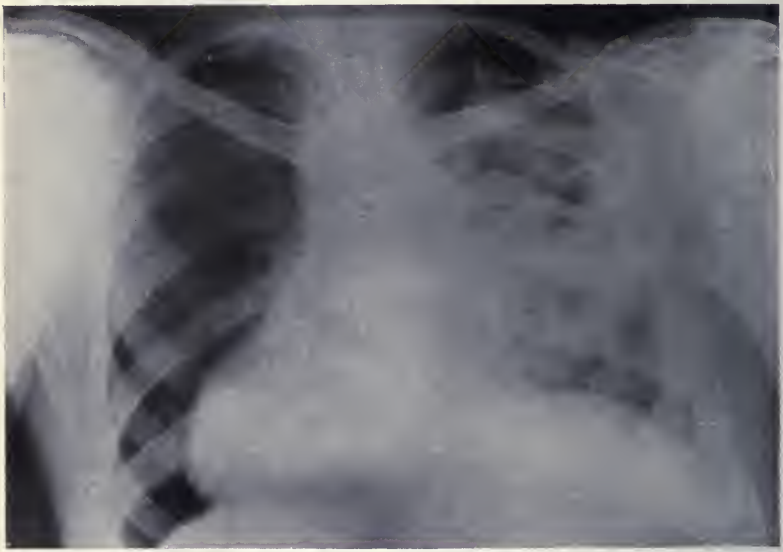
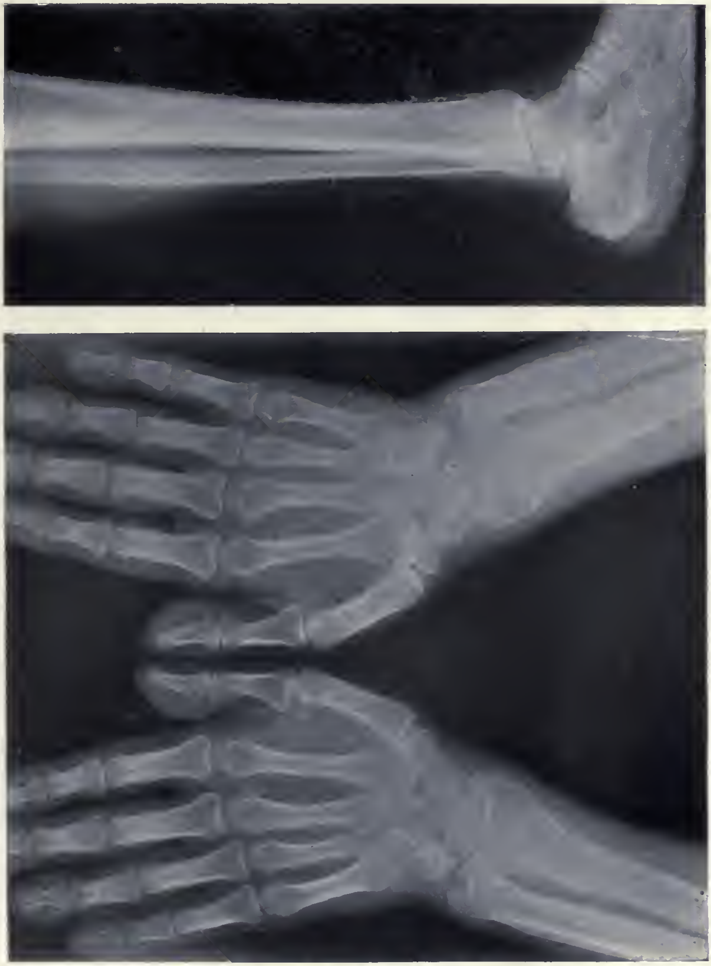


Fig. 148.—Röntgenogram showing improvement after drainage for two months.

How can we bring the findings which we have in the extremities, that is, the clubbing of the fingers and toes, the periosteal thickening along the course of the bones into relation to the lung abscess? Very probably there are two factors responsible for the changes: First, a chronic toxemia resulting from the long-standing infection in the chest; second, the circulatory disturbances resulting from the pulmonary involvement; similar infectious processes located in other parts of the body rarely produce these changes in the extremities. They are nearly always located



Figs. 149, 150.—Röntgenograms showing periosteal thickening on all the long bones with the exception of the phalanges.

within the thorax, and in the order of their importance are as follows: Chronic lung abscess, bronchiectasis, pulmonary tuberculosis with cavity formation, and chronic empyema. Actinomycosis of the lung might have to be considered, and lesions of the heart, particularly the congenital heart lesions, may lead to a clubbing of the fingers, but only very rarely to a periosteal hypertrophy in the bones of the extremities. A not uncommon cause of clubbing of the fingers is long-standing jaundice. A patient with common duct obstruction from stone in the ampulla of Vater, carcinoma of the head of the pancreas, or benign stenosis will have clubbing of the fingers in a very few weeks, and if the process lasts long enough, periosteal thickening of the bones of the extremities will result. Very rarely chronic suppurative processes in the abdomen will produce these changes as well as chronic infections of the kidney, a long-standing dysentery, and chronic liver abscess. However, the changes in the extremities produced by lesions outside of the chest are usually limited to clubbing of the fingers, the periosteal thickening being either absent or limited in amount. Just why a chronic inflammatory process in the lung leads to these changes, if the changes are due to toxemia alone, is difficult to say. I thought the condition might be attributed to the toxins of the material flora peculiar to the region. This is supported by the fact that chronic pulmonary tuberculosis with considerable circulatory embarrassment will not produce bony changes except when there is cavity formation and secondary infection. Cultures were made of the sputum from this patient by Dr. George Coleman, and the Bacillus annuliformans, Streptococcus viridans, and a hemolytic streptococcus were isolated. Broth cultures were made and toxins of the organisms were prepared. These toxins were injected into a series of rabbits over a period of six weeks. The lung of one rabbit was kept collapsed and the femoral vein of another was ligated in an endeavor to simulate to some extent the circulatory disturbances in this patient, but *no* bony changes or clubbing of the toes were produced.

The urine examination in this case was negative and there were no evidences of amyloid disease. To be sure that this pulmonary process was not syphilitic, we had two or three Wassermanns made, but the results were negative.

The primary pulmonary condition here is somewhat uncertain. It may have been a mild pneumonia which led to the abscess formation or it may have been an interlobar empyema. We were very suspicious of tuberculosis because of the history of the onset of the disease and the mild course for the first two months, but the persistent failure to find tubercle bacilli in the sputum tended to rule out such a possibility. Apparently the suppurative process wherever primary ruptured into a bronchus at the end of two months, when the profuse expectoration appeared.

I operated on this patient under a local anesthetic and drained the lung abscess in the following manner: With the patient lying on his left side and the right shoulder elevated, a needle was introduced below and internal to the angle of the scapula into the abscess, and the rib immediately above the needle was resected. The lung was adherent to the chest wall and the pleural cavity was obliterated, as we had been led to expect from our previous examination. Having the lung with the adherent pleura exposed, the abscess was opened with a Paquelin cautery by burning along the course of the needle until we had entered the cavity. When the abscess cavity was entered with the cautery, bleeding occurred into it and the patient expectorated a considerable quantity of blood-stained pus. Considerable pus and air escaped from the wound with each respiration. The drainage-tube which was then inserted has been kept in place ever since. The postoperative course has been favorable and there has been a gradual improvement in the patient. The temperature immediately went down to normal, where it has remained. The discharge from the drainage-tube was profuse for about two weeks, since which time it has gradually diminished, and now, two months after the operation, it is very slight. The expectoration rapidly decreased and is now very small in amount, whitish-yellow in appearance, and has lost its fetid odor. Evidently the anaërobic infection has greatly diminished. The patient now goes to bed and sleeps all night, whereas before operation he would cough up two or three sputum cupfuls during the night. He weighed

142 pounds when he came in. As a result of the operation he went down to 135, but now has gained 20 pounds and feels very greatly improved. I will show you the *x*-ray plate of his chest made recently. It shows, as you see, a marked resolution of the shadow cast by the abscess in the former plate. There is a decrease in size as well as in the density of the shadow (Fig. 148).

Can you offer any criticism of the operation? From the plate you can see that the fifth rib posteriorly was resected. This is over the upper portion of the cavity. I think it would have been better had I resected two ribs lower, because when the patient is in the upright position the drainage would then be in the most dependent portion of the abscess. It was my intention to resect the seventh rib, but with the patient on his left side and the right arm thrown forward and upward the angle of the scapula was also elevated. This made me resect the rib higher up, reckoning that the angle of the scapula was still at the seventh rib. For that reason, if you are going to use the angle of the scapula as a guide in identifying the seventh rib in cases of rib resection, be sure you have the arm by the side when you make your deductions. Rib resection at the level at which I made it is objectionable not only because of poorer gravity drainage, but because of pinching of the tube by the scapula and fixation of the scapula by the formation of adhesions. This has occurred here, and as a result the movements of the right arm are still decidedly restricted.

What will be the outcome in this case? Will the abscess go on to healing and leave no sequelæ? An acute lung abscess if it is drained or ruptures into a bronchus is usually followed by healing, but a chronic lung abscess with marked induration of its walls and obliteration of the pleural cavity, even if it is drained to the outside, is very slow about closing. Here there is still a communication with the bronchus. When the patient coughs or takes a deep breath the air passes in and out of the tube. We know that it does not go into the pleural cavity because the pleural cavity is obliterated. Bronchial fistulæ sometimes persist and are very resistant to all forms of treatment.

If this abscess does not heal, what additional measures might be resorted to? It has been suggested that Beck's paste injected into the fistula might be of value, but I do not believe its effect would be curative. A decompressing operation on the chest wall could be performed, permitting collapse of the lung and of the abscess wall. The Friedrich operation is the operation of choice in such cases. In it an incision is made from the second rib anteriorly, beginning about 1 inch to the right of the sternal margin, running downward and backward to about the tenth rib, and then backward and upward midway between the mesial border of the scapula and the spinous processes to the third rib posteriorly. A flap including muscles and angle of scapula is dissected upward and the ribs exposed. The periosteum is split along each rib, and with a special instrument it is stripped off, and the entire rib except a small portion posteriorly is removed from the second to the tenth inclusive. Then the flap is brought down and sutured in place. The chest is held in a collapsed condition by properly applied bandages. This operation may lead to healing of a chronic lung abscess without preliminary drainage, or if preliminary drainage has been established and has been unsuccessful, its performance may lead to a cure. As the procedure is an extensive one and the operative risk considerable it should be done only when, months after the drainage of the abscess, there appears to be no tendency for it to heal.

With improvement in the lung abscess in this case there has been a diminution in the bony changes. You see in the *x*-ray plates made recently a condensation and lamellation of the periosteal thickening along the bones of the forearms and legs. We will follow this condition with the *x*-ray and expect it eventually to disappear as the healing process in the lung abscess advances.

CLINIC OF DR. LOUIS A. GREENSFELDER

MICHAEL REESE HOSPITAL

DEMONSTRATION AND REDUCTION OF AN OLD SUBCORACOID DISLOCATION OF THE SHOULDER

BY DR. DAVID C. STRAUS

Summary: A patient with a shoulder dislocation of two months' duration; signs of dislocation of the shoulder—Dugas' test; Callaway's test; Bryant's test; value of stereoscopic röntgenograms; mechanism of shoulder dislocation; incomplete dislocation; complete dislocation; anatomic varieties; luxatio axillaris erecta; "old" dislocations; changes in the tissues in old dislocations—importance of the retracted subscapularis muscle in preventing reduction; other factors; indications for open operation; arthrotomy the operation of choice; the Dollinger operation; reduction without open operation.

THIS patient, a female, fifty-two years of age, comes to the hospital because of limitation of motion and lameness in the right shoulder-joint.

The trouble started two months ago, when the patient fell to the ground during a convulsion. The patient does not know how she landed. After the fall she could not move the right arm at the shoulder very well, and had pain in the shoulder and in the muscles of the right upper arm. She noticed that the skin about the shoulder region was discolored, black and blue. A physician who was called had a röntgenogram taken. This, he said, showed that the shoulder was dislocated. He manipulated the shoulder and believed he had reduced the dislocation. He did not immobilize the arm, and she has been using it to the best of her ability ever since the accident. The arm has not recovered its former usefulness, however, and she comes to the hospital to find out if something can be done for the condition.

As may readily be seen, we have here what you will all probably recognize, a typical picture of a subcoracoid dislocation of the shoulder. We make this diagnosis from the following findings: On inspection, you will note that the right shoulder is flattened; that this bone, the acromion process, is unduly prominent; that the right arm is held in an unnatural position, being abducted in an awkward manner, and that there is an abnormal prominence below the coracoid process. Palpation shows that the glenoid cavity is empty, and that nothing but soft parts intervene between the palpating finger and the glenoid cavity, which is felt to be smooth. The head of the humerus can be felt under the coracoid process of the scapula. We next direct our attention to the *special signs* or *tests,* which are present in almost all varieties of *dislocation of the shoulder.* We will consider them in the order of their importance: (*a*) The elbow, as you see, is abducted somewhat from the side of the chest. In case a dislocation is present, it is impossible to place the hand on the opposite shoulder and at the same time bring the elbow against the chest wall. This is called *Dugas' test.* This test is positive in almost all dislocations of the shoulder, though it may sometimes be negative in the subcoracoid type. We will try the test. You see the test is positive in our case. (*b*) The vertical measurement around the axilla is increased—this is called *Callaway's test.* In our case the measurement is 40 cm. on the right side and 36 cm. on the left, or normal, side. (*c*) Inspection shows that the anterior or posterior axillary fold is lowered. This is called *Bryant's test.* In our case you see that the right anterior axillary fold is lower than the left. Finally, after completing the physical examination, *a set of stereoscopic röntgenograms* should be taken. These are of the greatest value in cases of this kind, not only as a means of diagnosis but also as an aid in directing our treatment. This will be referred to later. Stereoscopic röntgenograms have been taken in this case and they confirm our diagnosis, as you can see (Fig. 151). You see the glenoid cavity is empty and the head of the humerus lies in front of, internal to, and a little below its normal site, and rests on the anterior surface of the neck of the scapula, below the coracoid process. You notice that there is an irregular defect at the lateral side of the largest part of the head and that there is a fragment of bone, covered with periosteum, lying just lateral to and in contact with the periosteum of the portion of the greater tuberosity, just below the defect to which we just called your attention. You see there has been a fracture of the lateral facet of the greater tuberosity. Dislocation of the shoulder is one of the important causes of fractures of the greater tuberosity of the humerus.

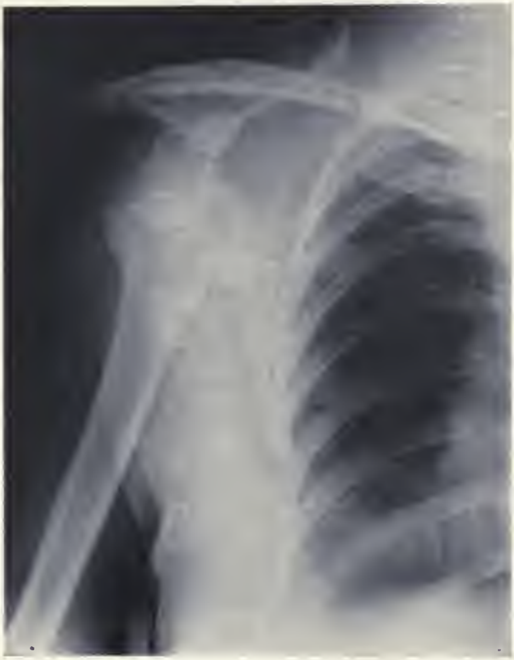


Fig. 151.—Subcoracoid dislocation, eight weeks' duration. Röntgenogram taken before reduction (one of a stereoscopic set).

Before speaking of the indications in this case and proceeding with the treatment, it might be well to review very briefly the various types of anterior dislocations of the shoulder, and to say a few words about old anterior dislocations of the shoulder in general.

Dislocation of the shoulder is by far the most frequent form of dislocation, occurring with slightly greater frequency than all other forms of dislocation combined; statistics show that it constitutes from 52 to 55 per cent. of all dislocations.[1] This great frequency of shoulder dislocations is explained by: (*a*) the exposed position of the shoulder; (*b*) the very great range of movement of the joint; (*c*) the marked disproportion between the comparatively large head of the humerus and the relatively small and quite shallow glenoid cavity, the surface of which is only one-quarter to one-third of the head of the humerus; (*d*) the long leverage afforded by the humerus, the entire upper extremity acting as the long arm of the lever; (*e*) the weak point in the joint capsule, below and in front; and (*f*) the fact that the strength of the joint depends largely on muscles. The joint capsule is reinforced above by the coracohumeral ligament which radiates out into its upper and posterior wall. The capsule is reinforced also by the glenohumeral ligaments, the superior, middle and inferior, but these are very variable in their development. In addition, it is strengthened above and posteriorly by the tendons of the supraspinatus, infraspinatus, and teres minor muscles. In front and above, the tendon of the subscapularis muscle near its insertion to the humerus is firmly attached to the joint capsule. Immediately below, the joint capsule is strengthened by the long head of the triceps. Thus the weakest part of the joint capsule is anteriorly and below, between the tendons of the subscapularis and teres major muscles. This explains why forward dislocations are so much more frequent than backward dislocations, the relative frequency being 97.5 to 2.5 per cent., according to Finckh.[2]

The most frequent cause of dislocation of the shoulder is hyperabduction of the arm with the scapula fixed, as a fall on the inner side of the elbow, or a sudden jerk while the hand is held abducted above the head, as while holding on a strap in a street car which suddenly gives a jerk. Any such maneuver forces the surgical neck of the humerus upward against the under surface of the acromion, which acts as a fulcrum, the shaft of the humerus acting as the long arm of a lever, and the head and neck of the humerus as the short arm of the lever. The head of the humerus is thus forced against the antero-inferior part of the capsule, the anatomically weakest point, which gives way, and the head passes out through the rupture in the capsule thus caused and passes downward and inward. Any other force that presses the head of the humerus downward and inward against this weak part of the capsule also may cause a dislocation; for example, a force applied directly to the upper end of the humerus, as a fall on the shoulder. Sometimes even muscular action alone will accomplish this.

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[1] Hofmeister and Schreiber: Handbuch der praktischen Chirurgie, 1914, vol. v, p. 51.

[2] Finckh, J.: v. Bruns' Beiträge, Bd. 17.

In case the joint capsule is not ruptured, but is torn from its attachment at the anterior margin of the glenoid cavity, together with the periosteum of the neck of the scapula, the head of the humerus will pass downward on to the neck of the scapula, in close relationship to the glenoid cavity. This is called an *incomplete* dislocation of the shoulder. The arm is strongly rotated outward and the bicipital groove looks forward. Rarely even a subcoracoid or intracoracoid position may occur without rupture of the joint capsule.

If the joint capsule gives way, and the head of the humerus passes out through a rent in the capsule, a *complete* dislocation results. As a rule, in almost all dislocations of the shoulder, no matter what the cause may be, the head passes out in a downward and inward direction, through the anatomically weakest part of the capsule, down into the subglenoid space, and, depending on the further course of the head of the bone, various types of forward dislocation are described. As the case we have to deal with today is one of the forward type, we will discuss forward dislocations only.

If the head of the humerus remains resting on the facies subglenoidalis of the scapula, displacement upward underneath the coracoid process being prevented by the intact anterior portion of the capsule, we have the so-called *axillary* dislocation. If the cause of the dislocation be hyperabduction of the arm, and the weight of the arm does not, as usually follows, cause the arm to fall to the side, but the arm remains upward, while the head of the humerus remains in the subglenoid space, we have the rare "luxatio axillaris erecta," which occurs in about ½ per cent. of cases of forward dislocations. Usually, however, the force that caused the tear in the capsule continues and carries the head forward and inward, and as the arm falls to the side the head passes inward and upward so that it comes to rest on the anterior surface of the neck of the scapula, underneath the coracoid process. This is the *subcoracoid dislocation* (Fig. 152) and is the most frequent variety. In an anteroposterior röntgenogram (Fig. 151, the case we have to deal with today) the coracoid process is seen to lie at about the midpoint of the head of the humerus, dividing it into two approximately equal halves. The anatomic neck rests on the anterior lip of the glenoid fossa (Fig. 152). The posterior part of the capsule, together with strengthening bands and tendons, lies stretched over the glenoid cavity and prevents the head from being carried further toward the median line (Fig. 153). In case the force has been greater, so that the head of the humerus is carried

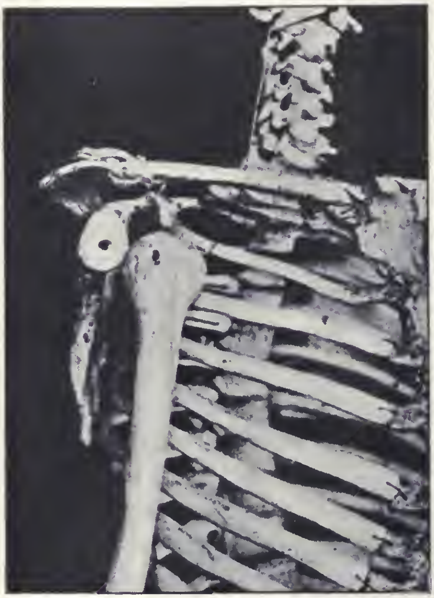

Fig. 152.—Subcoracoid dislocation (Dollinger).

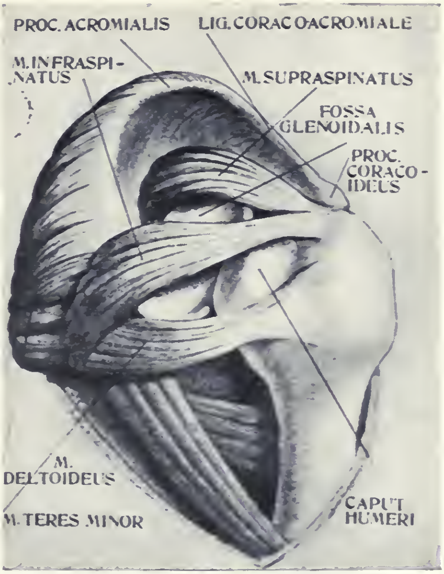

Fig. 153.—Subcoracoid dislocation seen from behind. The external rotators are drawn over the glenoid cavity (Dollinger).

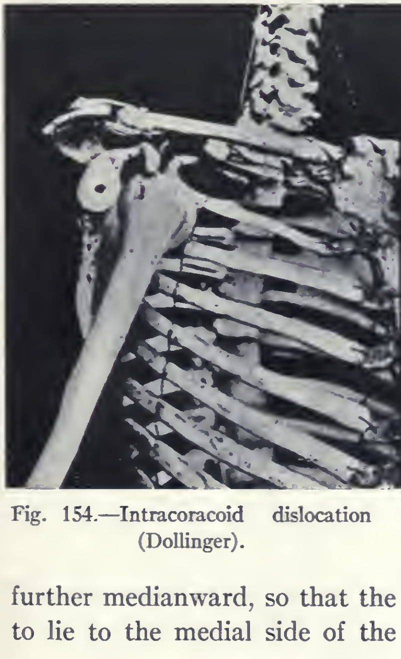

Fig. 154.—Intracoracoid dislocation (Dollinger).

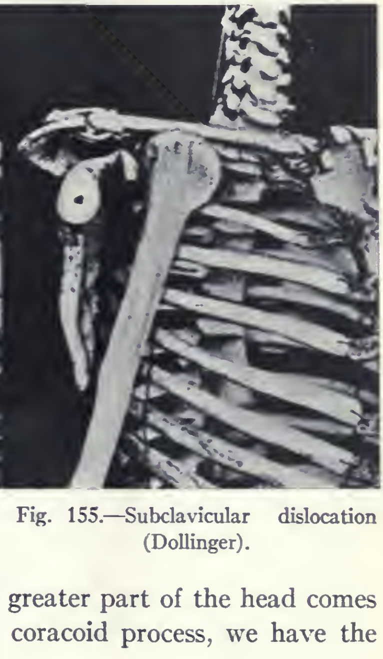

Fig. 155.—Subclavicular dislocation (Dollinger).

further medianward, so that the greater part of the head comes to lie to the medial side of the coracoid process, we have the so-called *intracoracoid dislocation* (Fig. 154). The head of the humerus lies partly upon the scapula and partly upon the adjacent ribs. The sulcus intertubercularis looks directly forward. To reach this position the posterior portion of the capsule, together with the strengthening bands and the supra- and infraspinatus muscles, are either greatly stretched, or, what is more usual, they are torn away from the humerus, together with the greater tuberosity. If the greater tuberosity is completely torn away from the humerus, it may lie in the glenoid cavity and be an obstacle to reduction. However, it often remains attached to the humerus by means of the periosteum. If the dislocating force carries the head of the humerus still further medialward, so that it comes to lie under the pectoralis minor muscle, against the edge of the clavicle, we have the so-called *subclavicular dislocation* (Fig. 155). This is quite rare. To reach this position the head frequently tears through the subscapularis muscle, button-holing it, or the subscapularis

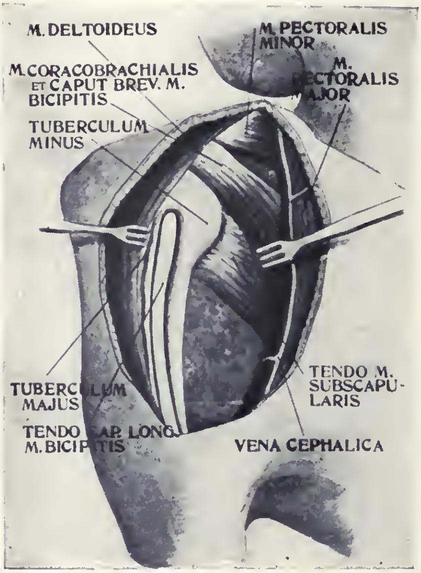

Fig. 156.—Open reduction of subcoracoid dislocation. Incision and anatomic relations in a subcoracoid dislocation (Dollinger).

muscle is torn off from its insertion on the lesser tuberosity. The arm is often rotated inward and strongly adducted, but it may be in almost any position, as the muscles are greatly stretched or torn. Nerve injuries, and hence paralyses, occur much more frequently in the intracoracoid and subclavicular forms than in the other types of forward dislocations.

Without going into detail as to the symptoms of the various forms of forward dislocation, it should be pointed out that, in attempting to differentiate the various forms from one another, the diagnosis is greatly aided by the röntgenogram, but one must not depend on this alone, for a picture taken in a slightly oblique direction may easily lead to false conclusions.

We have said that the case we have to deal with today is an *old* dislocation. What do we mean by an old dislocation? When does a recent dislocation become old? Obviously it is impossible to state any definite time, but *a dislocation that has persisted for from four to six weeks may be termed old*, for by this time all reaction in the injured tissues has passed away.

Old dislocations are observed much more frequently in the shoulder-joint than in all other joints (97.5 per cent. according to Smital[1]; 97 per cent. according to Finckh[2]).

From the clinical point of view old shoulder dislocations may be divided into two groups. The extracoracoid and subcoracoid dislocations may be considered together as one group. In these the pathologic changes are not of very high grade as a rule. Similarly, the intracoracoid and subclavicular dislocations may be considered together as a group. In this group the changes are much more marked. In all old anterior dislocations the dislocated head of the humerus becomes surrounded with more or less connective tissue, which practically forms a new capsule and soon entirely hides the tear in the true caspule. The slight differences that exist between an extracoracoid and a subcoracoid dislocation are lost in old cases. In the *subcoracoid type* the following *pathologic* and *clinical findings* exist and can be made out when open operation has to be resorted to: The head of the humerus remains in the im-

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[1] Smital: Wiener med. Wochenschr., 1890, No. 52, S. 2251–2254.

[2] Finckh, J.: v. Bruns' Beiträge, Bd. 17.

mediate vicinity of the glenoid cavity, on the neck of the scapula. The half-spheric prominence that can be palpated below the coracoid process is the greater tuberosity. The greater tuberosity is directed forward and laterally, and the lesser tuberosity is directed forward and inward. The bicipital groove, with the contained long head of the biceps, shows plainly the boundary between the two tuberosities and lies somewhere between the coracobrachialis and short head of the biceps muscle. The greater part of the head of the humerus lies lateral to these muscles. The head of the humerus is turned backward, and lies in front of, internal to, and a little below its normal site, the upper portion of the head often resting against the anterior margin of the glenoid cavity. There is frequently a vertical groove on the head corresponding to this area of contact, which may be the result of long-continued pressure or may have been caused during forcible attempts at reduction. The cartilage covering the head of the bone, if it has not been accidentally damaged during the trauma, remains smooth and normal in color even two or three months after the dislocation. In older cases this cartilage becomes uneven or rough and turns brown. This irregularity of the head may be due not only to atrophy of the cartilage but also to irregular exostoses. In still older cases, after one year or so, the cartilage on the anterior half of the head becomes completely eroded and the exposed spongiosa is covered by a thin layer of smooth connective tissue. In very old cases the normally firm attachment between the cartilage and the head loosens, and during attempts at reduction, if great gentleness is not exercised, the cartilage may be torn away. The cartilage covering the glenoid cavity shows the same changes. The heavy tendons of the supraspinatus, infraspinatus, and teres minor muscles, near their insertion into the greater tuberosity, are drawn inward and cover the glenoid cavity (Fig. 153) above the coracohumeral and glenohumeral ligaments, which they exceed in breadth and thickness. The posterior segment of the capsular ligament that lies below these strengthening bands is usually not torn in this type of dislocation, and there are usually no adhesions between the joint capsule and the cartilage covering the glenoid cavity, except in cases in which the dislocation has been of very long standing, or in case of fracture through the glenoid cavity, in which case there are adhesions between the capsule and the site of fracture.

A newly formed acetabulum may develop on the neck of the scapula. Adhesions may develop between its anterior segment and the anatomic and surgical neck of the humerus and interfere somewhat with reduction, but this is only of importance in case the dislocation is complicated by fracture of the surgical neck, and masses of callus strengthen the union between the scapula and the humerus. In the absence of a fracture the adhesions do not form any marked hindrance to reduction as a rule. Usually the difficulty of reducing an old shoulder dislocation is not due, as formerly believed, to newly formed connective-tissue scars, or, as Kocher[1] has stated,

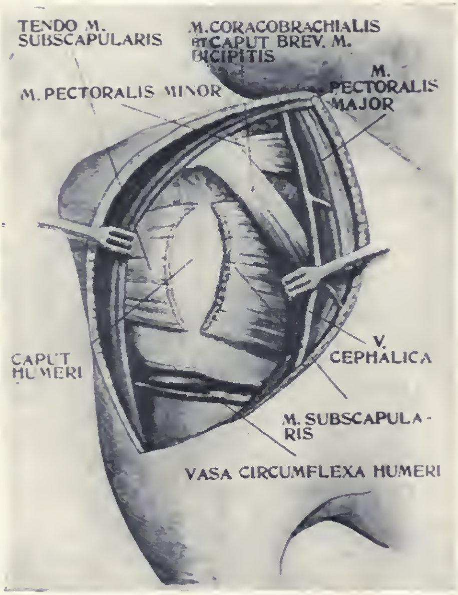

Fig. 157.—Open reduction of a subcoracoid dislocation. Site of division of the subscapularis muscle and the relations of the circumflex vessels (Dollinger).

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[1] Kocher: Deutsche Zeitschr. f. Chir., Bd. 30, Heft 4–5, S. 423–460.

to adhesions in the vicinity of the old tear in the capsule, between the margin of the labrum glenoidale and the anatomic neck, but, *as recently pointed out by Dollinger,*[1] *the difficulty of reduction is due chiefly to the retracted subscapularis muscle,* which, because of pressure, has become sclerosed. Because of the dislocation, the points of origin and insertion of this muscle are approximated as much as 1 to 3 cm. Dollinger has never found it necessary to divide the coraco- or glenohumeral ligaments, which Kocher has stated constitute a hindrance to reduction. Dollinger deserves the credit of having demonstrated that *if the subscapularis muscle is divided by open operation,* as will be described later, *reduction is easily accomplished.*

In *old intracoracoid* and *old subclavicular dislocations* the head of the humerus has been displaced much further medialward, and lies for the most part or entirely internal to the coracoid process (Figs. 152 and 154), and, therefore, lies to the medial side of and beneath the muscles running from the coracoid process to the humerus—*i. e.*, the short head of the biceps and the coracobrachialis muscles. These muscles, which are tensely stretched in this group of dislocations, may and often do interfere with reduction, for in rotating the head of the humerus outward it catches on these muscles. Therefore, to reduce cases of this type one must abduct strongly and make strong traction on the arm in order to drag the head of the humerus under these muscles before one can replace it in the joint socket. But in old dislocations of this type, where this displacement has remained for weeks or months, these muscles become sclerotic and it is not possible to draw the head outward under these muscles. Dollinger and Legueu[2] have each reported a case in which it was absolutely impossible to reduce the dislocation until these muscles had been divided, and Murphy[3] reported a case in which he found it necessary to temporarily resect the coracoid process and the long head of the biceps. The axillary vessels and the large nerve trunks lie in front of the head of the humerus, but are separated from it by the subscapularis muscle, which is bulged forward by the head of the bone. Small tears are produced in the muscle by the trauma of the dislocation, and in old cases the extravasation thus caused organizes and produces adhesions between the nerves and vessels and the muscle. The subscapularis muscle may be torn, though this is quite exceptional. The head of the humerus may perforate the muscle, button-holing it, or the muscle may be torn away from its insertion on the lesser tuberosity. In either case the head of the bone lies in immediate contact with the large nerve trunks and vessels and may become adherent to them, though, as stated before, this is quite exceptional. The intracoracoid and subclavicular dislocations are frequently complicated by *fracture of the greater tuberosity.* This is due to the fact that the tendons of the outward rotators of the arm, inserted on the greater tuberosity, the supraspinatus, infraspinatus and teres minor, which are drawn inward over the glenoid cavity, so that they cover the joint cavity in all forward dislocations, are greatly stretched in the intracoracoid and subclavicular types and tear away the greater tuberosity. However, another mechanism may come into play. The anterior margin of the glenoid cavity may be forced into the furrow between the posterior margin of the head and the tuberculum majus, and if the causal trauma forces the head of the bone against this sharp ridge the tuberculum majus will be cut away by this bony margin acting like a wedge. The entire tuberosity may be torn away or only a part of it. In our case you see from the radiograms that the outer facet only has been torn away (Fig. 151). The *fractured tuberosity interferes with reduction only in case it has become adherent to the glenoid cavity or when it has become wedged in between the glenoid cavity and the acromial process.* The long head of the biceps is occasionally torn out from the bicipital groove and may interfere with reduction. In addition to the interference with reduction caused by these structures, which does not often occur, *the chief obstacle to reduction in old cases is the retracted subscapularis muscle.*

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[1] Dollinger: Ergebnisse der Chirurgie und Orthopädie, Bd. 3, Berlin, 1911, S. 104.

[2] Legueu: Independence med., 1901, No. 15 (quoted by Dollinger).

[3] Murphy, J. B.: The Surgical Clinics of John B. Murphy, vol. ii, No. 3, June, 1913, p. 419.

In both groups of dislocations fracture of the surgical neck of the humerus may occur, though this is a rarer complication. Healing may have occurred in a position that makes it possible to reduce the dislocation or it may have healed in such a position that it prevents reduction. The external callus may so surround the nerves and vessels and be so adherent that it is difficult or impossible to free them. These cases are generally not well adapted for reduction, and the results are poor as regards function, whether one reduces them or resects, because of the callus that penetrates the muscles.

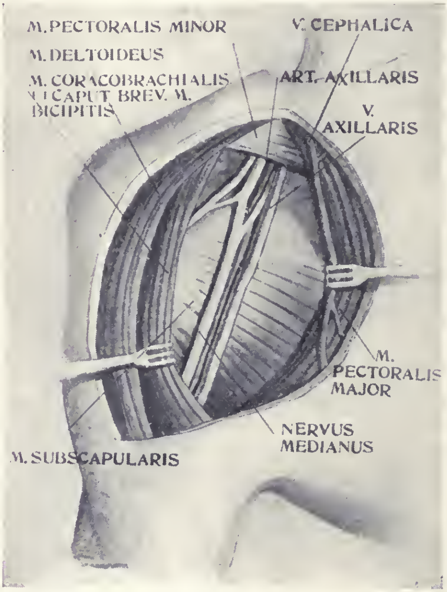

Fig. 158.—Incision and anatomic relation in a case of intracoracoid dislocation (Dollinger).

While the amount of motion which the displaced head may develop depends on whether the arm has been used from the outset or not, and may vary greatly—in some cases the arm may be almost as useful as normal—as a rule an unreduced dislocation of the shoulder cripples the patient markedly. This patient used her arm from the day the dislocation occurred and this explains why her limitation of motion is so slight.

The chances of reduction without operation is directly dependent upon the amount of time that has elapsed and the anatomic findings in the particular case. According to the statistics collected by Finckh,[1] reduction always succeeded in uncomplicated cases that had lasted less than four weeks, was successful in 77 per cent. of cases between the third to the ninth week, but was unsuccessful in all cases existing longer than fourteen weeks. However, there is no time limit after which reduction is no longer possible, for there are rare cases reported in which reduction was accomplished after many months or even years. Dislocations associated with complications are usually irreducible earlier than uncomplicated dislocations. For this reason intracoracoid and subclavicular dislocations become irreducible after a few weeks, if they are not irreducible from the very outset, due sometimes to the interposition of the tuberculum majus which is so frequently fractured, or to the obstruction offered by the long head of the biceps which is occasionally torn out from the sulcus intertubercularis; later difficulty in reduction may be due to the formation of adhesions due to the relatively great trauma to the soft parts, and in particular to the obstruction caused by the short head of the biceps and the coracobrachialis muscles, which become sclerosed and may even become ossified. Old dislocations associated with damage to the large vessels or nerves, or with fracture of the neck of the humerus, give a notoriously bad prognosis.

Thus it can be seen that the treatment of old dislocations of the shoulder requires great care, and each case must be individually considered as regards the indications presented.

No attempt at reduction should be made if there is no probability of success, especially in old, weak individuals in whom the danger of producing a fracture of the humerus is greater, and particularly if the dislocation is of very long standing and there is a fair amount of mobility. This is all the more true in case the patient cannot be relied upon to co-operate in the after-treatment, for even if reduction is accomplished ankylosis is apt to result.

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[1] Finckh, J.: v. Bruns' Beiträge, Bd. 17.

If there is no contraindication, reduction should be attempted very carefully by the various methods employed to reduce recent dislocations. But as it is essential to attempt the reduction under an anesthetic, and in case simple reduction fails, to resort to open operation to accomplish the reduction, the patient should be prepared as for any other operation, and the attempts at reduction should only be made on the operating table, everything being in readiness for the operative interference, in case that should be found necessary.

While our patient is being put under the anesthetic (we always prefer ether in these cases) we might say a few words about the *operative indications.*

In case attempts at simple reduction fail, one must consider *operative reduction and resection of the head of the humerus.* The *indication for open operation* depends on the age and social standing of the patient, the duration of the dislocation, particularly the amount of pseudo-arthrosis formation present, etc., but the indication *is absolute in case there are symptoms of pressure on nerves or vessels. Subcutaneous division* of the muscles offering resistance to reduction or of adhesions, a procedure formerly employed by many clinicians, should never be done because of the danger to important structures, especially the large vessels, which are so frequently displaced and adherent. Open reduction—*i. e., arthrotomy—has become more and more the operation of choice,* and has recently been beautifully worked out and described by Dollinger, and his report on the subject must be regarded as a classic. Only in case open reduction fails, or during an attempt at it, the necessity of resection becomes evident should one decide on resection. Schoch[1] recommends resection in case the head is markedly deformed and hypertrophic or the glenoid cavity has become so shallow that it offers an insufficient hold for the head.

Infection following open reduction or necrosis of the head may give the indication for *secondary resection.*

Dollinger has shown rather conclusively that the chief obstacle to reduction is not to be attributed to complications on the part of the capsule, which Schoch, Kocher, and others have considered to be the prevailing obstacles to reduction in old dislocations, but retraction and sclerosis of the subscapularis muscle, which he found was present in all of his cases. His operation, and that is probably the best procedure in these cases, consists essentially in performing an open division of the subscapularis muscle, near its insertion into the lesser tuberosity. Following this the dislocation can usually be easily reduced. His technic is as follows:

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[1] Schoch: Beiträge zur klinischen Chirurgie, Bd. 29, Heft 1, S. 126.

With the patient in a half-sitting position, and an assistant holding the affected arm flexed at the elbow, an incision is made, beginning at the clavicle above and extending downward to the insertion of the deltoid below, the incision being carried along the line of the cephalic vein, corresponding to the groove between the pectoralis major and deltoid muscles. These two muscles are then bluntly separated, using the cephalic vein as a landmark; the deltoid is retracted laterally; the pectoralis major, together with the short head of the biceps and the coracobrachialis, are retracted medially; the pectoralis minor is retracted upward (Fig. 156). By so doing the bicipital groove and the lesser tuberosity of the humerus are exposed to view. The bicipital groove serves as the landmark for further orientation. To the medial side of this the tendon of insertion of the subscapularis muscle is found inserting on the lesser tuberosity. The assistant now rotates the arm outward, whereby the lesser tuberosity is brought more into the field. In case it is impossible to rotate the arm far enough outward to make the tendinous insertion available, an assistant applies a hook to the coracoid process and draws the scapula strongly outward and backward, away from the body, thus making the tendon of insertion accessible. This is, however, rarely necessary. In case we have to do with a subcoracoid dislocation, as today, the tendon of the subscapularis is now divided, from above downward, at the inner margin of the tuberculum minus, the scapel being carried boldly down against the bone (Fig. 157). While this is being done the arm should be held rotated outward as far as possible, as this facilitates division. One must exercise great care in dividing the lower portion of the tendon, for the anterior circumflex artery and vein (Fig. 157) lie directly against the neck of the humerus, immediately below the lowermost small muscle bundles of the subscapularis, which insert directly on to the neck of the humerus. The posterior circumflex vessels and the circumflex axillary nerve course posteriorly about the neck of the humerus at the same level. The large vessels and nerves lie to the inner side of the head of the humerus and are held aside with the coracobrachialis muscle. As soon as the subscapularis muscle is divided it retracts for 3 to 4 cm. and in this space the head of the humerus is visible. The assistant now reduces the head by the usual Kocher's maneuvers, which should be carried out slowly and carefully. By these maneuvers adhesions about the surgical neck are broken up, and as soon as this occurs reduction is easily accomplished in uncomplicated cases.

In *intracoracoid* and *subclavicular dislocations* the coracobrachialis and short head of the biceps lie either in front of the tuberculum majus or lateral to it, and it is not always easy to draw these muscles inward over the tuberosity to its inner side. If they cannot be drawn inward, they are retracted strongly outward. The nerves and large blood-vessels now lie exposed (these do not come into view in the subcoracoid dislocations) and the head of the humerus lies beneath them (Fig. 158). The large vessels and nerves sometimes are firmly adherent to the fascia of the subscapularis muscle just at the point where one divides the tendon, and in these cases one must exercise great care not to injure the artery in pushing these structures aside. After the tendon of the subscapularis is divided the dislocation is reduced by means of the Kocher maneuvers, but in case of intracoracoid dislocations sometimes the head of the humerus, which is rotated outward, catches on the short head of the biceps and the coracobrachialis muscles and it is impossible to carry it beneath these muscles. In such cases the arm, which is abducted and acutely flexed at the elbow, is pulled downward strongly—*i. e.*, caudally—and this may succeed in drawing the head of the humerus under these muscles. Rarely it may be necessary to divide these muscles in case they are very much retracted or sclerotic. This was referred to before. After this has been done reduction is easy. The divided muscles are sutured after reduction is affected.

The great tuberosity, which, as has been stated before, is not infrequently fractured in intracoracoid and subclavicular dislocations, if fractured may interfere with reduction. Dollinger found this in 3 of his 6 cases. In these cases the fractured tubercle lay in the glenoid cavity, and he entered the joint by means of an incision, beginning at the anterior margin of the deltoid muscle and carried transversely across the muscle to the point where it is most convex, removed the tubercle from the glenoid cavity, and sewed it back in its original site. Even in the cases in which the fractured tuberosity does not interfere with reduction Dollinger believes it is advisable to sew the tubercle in place, as he is of the opinion that if this is not done the action of the outward rotators is forever lost. As a result of experiments on the cadaver he has evolved the following operative procedure: He enters the joint from in front, as described above, and by direct inspection convinces himself that the tubercle is fractured, divides the subscapularis tendon, has an assistant draw the arm strongly distally, and then introduces the finger into the glenoid cavity through the space where the tendon was divided, which can be easily done, and convinces himself that the tubercle is free. Before the tendon of the subscapularis is divided it is impossible to reach into the glenoid cavity, for it is covered by the outward rotators which are stretched over it. After the tendon is divided we have free access to it.

In case the glenoid cavity is free, the humerus is at once reduced, and only after this is accomplished does one proceed to sew the fractured tubercle back into place, and to do this Dollinger gains access by means of a posterior incision. However, if the tubercle is adherent to the glenoid cavity he lays the patient on the sound side, and enters by an incision along the posterior margin of the deltoid muscle, beginning at the spine of the scapula above and carried downward as far as the insertion of the muscle on the humerus (Fig. 159). The deltoid is now retracted strongly forward, care being taken not to injure the branches of the axillary nerve which come out at the posterior margin of the muscle. In case this incision is not ample, one can gain more room by continuing the upper end of the incision outward along the spine of the scapula for a few centimeters, and thus loosen the attachment of the posterior bundles of the deltoid near their origin. As a rule, however, one is able to get along without this additional cut. The tendons and part of the stretched muscle bellies of the outward rotators now lie exposed, and by following these distalward we come upon the fractured greater tuberosity. This is exposed, the fractured surface freshened, and then temporarily replaced. If the arm could not be reduced before, this is now done. This being accomplished, the site of fracture on the humerus is freshened and then the tuberosity is attached to the humerus by means of either periosteal sutures, bone sutures, or with a nail (Fig.

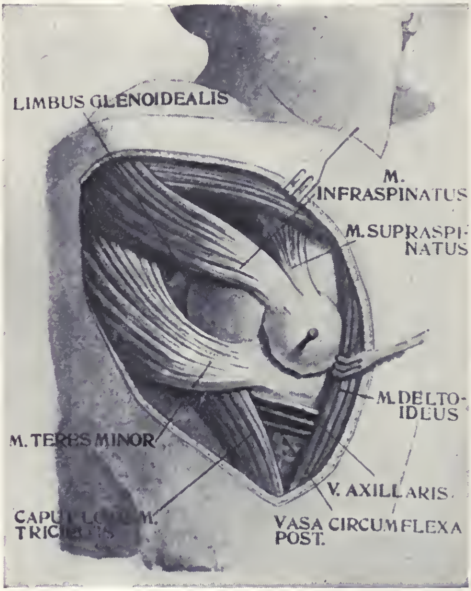


Fig. 159.—The incision for and one method of replacing the fractured greater tuberosity (Dollinger).

159). Because the outward rotators are stretched, they do not interfere with the replacement of the tuberculum majus to its original site.

In case the dislocation has been of long standing, and the outward rotators are accordingly greatly stretched, it is a question whether they can shrink to their normal length so that they can functionate normally again. Further experience alone will be able to determine this.

In case the long head of the biceps is torn away from the bicipital groove, it is returned and the anterior wall of the canal is re-formed by a plastic operation, using a flap of periosteum to accomplish this. Finally, all bleeding having been absolutely checked, the margins of the muscles are united by means of a few interrupted sutures, the skin wound closed, and a collodion dressing applied, a strip of gauze having been applied over the skin incision. No drain is inserted unless the operation has been a long one or there is other reason to fear infection.

The arm is then held in a sling. The stitches are removed in eight days. After this mechanotherapy is instituted.

Now that our patient is anesthetized and everything is in readiness for the open operation, we shall attempt to reduce the dislocation manually before resorting to operative interference.

The patient being completely relaxed, we draw her to the right side of the table and have an assistant support her in a semirecumbent position. The operator now stands in front of and to the right side of the patient, as you see, grasps the patient's right wrist with his right hand and her elbow with his left hand, and slowly but forcibly presses the patient's elbow to her side. The forearm is now flexed to a right angle at the elbow, thus, and the flexed forearm is now slowly, forcibly, but carefully rotated outward, gradually overcoming the resistance due to the muscular contraction and the adhesions that may have formed, continuing the outward rotation until the forearm is directed at right angles to the body and the inner side of the arm looks forward. At the same time an assistant makes strong downward traction on the arm, holding with both hands just above the elbow. Now, holding the arm in the same degree of outward rotation, the elbow is very slowly raised forward and upward as far as possible, and an assistant helps by directly pushing the head of the humerus upward and outward toward the glenoid cavity, with his right hand pushing against the inner and lower side of the head of the bone. Finally, the forearm, which has been held rotated outward, is now rotated and circumducted inward, the hand passing across to the opposite side of the chest—so. We shall try again. This time you see we have succeeded. The head of the humerus is now in its normal position. You see the flatness of the shoulder has disappeared, the axillæ on the two sides appear the same, Dugas' sign is now negative, the humerus can be moved freely, and the range of movement is normal. We shall hold the arm in this position by applying a Velpeau bandage, so that the

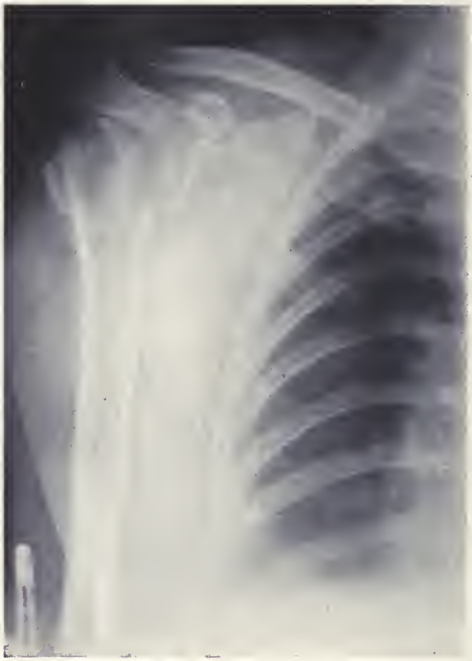


Fig. 160.—Röntgenogram taken after reduction (one of a stereoscopic set).

dislocation cannot recur, and shall leave this on for ten days. Tomorrow we shall have another set of stereoscopic röntgenograms taken to make certain that the reduction is complete.

Postscript.—The pictures taken the following day showed that the dislocation had been successfully reduced (Fig. 160).

The patient was discharged from the hospital on the tenth day, but was instructed to return daily for massage and passive exercises.

She did as instructed for the first few times, but was more easily satisfied than were we, and she has not been seen for some time now. The result at the time of her last visit was good, but could have been improved by further treatment. It has doubtless continued to improve, otherwise she would probably return, for, as mentioned at the outset, her reason for coming to the hospital in the first place was because of limitation of motion and lameness of the shoulder rather than because of any pain.

CLINIC OF DR. HUGH McKENNA

St. Joseph's Hospital

DEMONSTRATION OF CASES ILLUSTRATING IMPORTANT ASPECTS OF THE INDICATIONS, THE TECHNIC, AND THE RESULTS OF BONE TRANSPLANTATION AND ARTHROPLASTY

Summary: First Clinic—Nov. 6, 1916. Talk on the Lane technic for bone work.

Case I.—Hallux valgus—transplantation of the extensor proprius hallucis tendon—importance of a dry field.

Case II.—Fracture of neck of femur—operative treatment; the skin incision—exposure of joint—implantation of bone splint.

Case III.—Tuberculosis of first phalanx of finger; excision of tuberculous tissue and introduction of a bone splint.

Second Clinic—Jan. 16, 1917.

Case I.—Further report on case of tuberculosis of finger; successful transplantation of bone into an infected area.

Case II.—Ankylosis of elbow—arthroplasty; advisability of early operation in cases due to Neisserian infection; technic of raising and placing the fat and fascia flap; after-treatment.

Case III.—Double dislocation of shoulder with pathologic fracture of anatomic necks of both humeri as a result of muscle spasm; reduction by open operation; results.

Case IV.—Fracture of humerus in man sixty-four years of age; marked atrophy of humeral head; regeneration following bone transplantation and active use.

Case V.—Congenital absence of scaphoid; deformity corrected and deficiency of tarsus repaired by transplanting bone into the space which the scaphoid should have occupied.

November 6, 1916.

Before proceeding to the operations this morning I wish to explain in a general way the technic used in all open operations upon bones and joints. I may say that the technic followed in this clinic is that outlined by Mr. Lane, of Guy's Hospital, London, which I had the opportunity of observing eight years ago, and which I have followed religiously ever since. It is as follows:

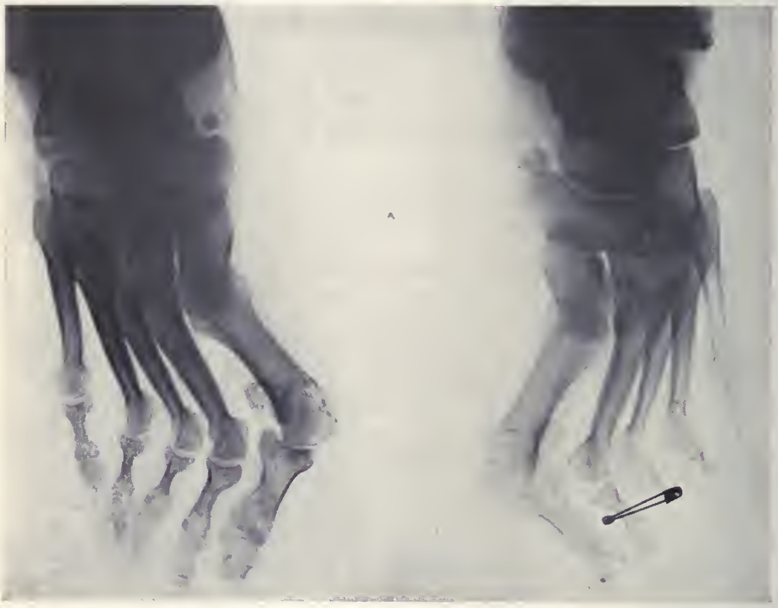
Whenever it is possible the part to be operated on is prepared for operation with a dry dressing for forty-eight hours previous to the time of operation. This permits of the application of the tincture of iodin to a dry skin surface, which I believe is of great importance. The instruments are sterilized in an especially arranged tray and brought to the instrument stand near the operating table without being dried. They are then covered with sterile towels. The sponges are brought up from the sterilizer in small wire baskets. This enables one to minimize the amount of handling of instruments and sponges. It has been my plan to designate one assistant for each line of work in these bone operations; for instance, one assistant handles all sponges and a sponge is introduced into the wound only once. Another assistant ties all knots, which are tied at the end of instruments. In this way it is possible to carry out any kind of a bone or joint operation without introducing anything other than sponges and instruments into the wound. This method I believe is desirable, and this belief is based upon the results of about 100 open operations on bones and joints with only one infection. In that instance we were of the belief that the infection was of hematogenous origin.

The same plan of technic is carried out in the operation for securing autotransplants. After the incision is made over the subcutaneous portion of the tibia the bleeding is stopped and the wound well retracted, using great care not to injure the tibialis anticus muscle more than necessary. When the incisions are made the edges of the skin are well covered with towels. The desired length and size of the tibial transplant is marked out by means of calipers and removed by means of an electrically driven saw. The transplant is lifted with two forceps in order to prevent the possibility of accident, and introduced into the place prepared for it and driven into place by means of instruments. The wound from which the transplant is removed is covered with gauze immersed in saline solution until the transplant is put in place and the original wound closed. The entire wound is closed with chromicized catgut, this material also being used to close the skin layer. Chromicized catgut has been found to serve this purpose well, since it is not necessary to remove the dressings until bony repair is complete. This is of especial importance where it is necessary to apply plaster-of-Paris dressings. The wound from which the transplant has been taken is closed with chromicized catgut and dressed in the same way.

CASE I.—DOUBLE HALLUX VALGUS

The technic just outlined will be followed in this case. The incision is made just external to the extensor proprius hallucis tendon. No part of the redundant skin is removed, as experience has shown that as repair takes place the skin contracts to its normal condition. In other words, if the skin were taken away considerable contraction would result. The incision is carried down upon the capsule of the joint. The joint is now opened. By means of a curved periosteotome the capsule and periosteum are separated from the outer side of the first metatarsal and the exostosis brought well up into the wound. With the aid of retractors the capsule is separated widely, so that the bony tumor can be removed, using a straight saw, without mutilating any of the surrounding tissues. The sharp edge of the synovial surface of the joint is rounded by means of a rongeur forceps, and the capsule previously prepared is now closed, leaving the joint in practically a normal condition. The outer half of the extensor proprius hallucis tendon is now drawn to the anterior and medial surface of the base of the first phalanx of the great toe, and sutured to the base of the capsule just where it is reflected over the inner surface of this bone. As healing occurs the stretch on this tendon tends to draw the toe into its normal position.

During this entire operation you will note that considerable attention was given to the question of preventing even a slight hemorrhage. This is done, first, because I believe it lessens the amount of pain from pressure, and, second and most important, because it lessens the possibility of infection in these joints. The wound is now closed with chromicized catgut, which is left in until the wound is entirely healed. Such suture material obviates the necessity of removing the cast in order to take out the stitches at the end of the seventh or eighth day. This is only a small point, but it is one that I believe minimizes the possibility of infection of the skin because of the unnecessary handling of the wound until the skin is completely healed. This is thirty-day chromicized catgut. The wound is now closed. You will note that I have been able to remove the exostosis without coming in contact with the wound except through the application of instruments and sponges, which have been taken directly from the sterilizer. The wound is now dressed with subiodid of bismuth powder and several layers of gauze dressing, being particular to place a sponge between the toes, which tends to correct the malposition of the great toe. A plaster-of-Paris cast is now applied, extending well over the end of the toe and covering the entire foot up over the ankle.



Figs. 161, 162.—Hallux valgus, a typical case.

We will now operate the right foot, which will be handled in the same way as the left. In connection with the operation just performed I believe it is much more important to get the work done aseptically than it is to follow any particular line of technic. However, the results in the hallux valgus cases have been very gratifying to me, especially since I have operated on a fair number of cases. These patients are instructed after leaving the hospital to dress the toes in the manner described above, and for at least six months to wear a shoe fairly wide and long.

Figures 161 and 162 show the type of case just operated on and are *x*-ray pictures of a case previously operated on by me.

CASE II.—FRACTURE OF THE FEMUR TREATED BY MEANS OF AN AUTOTRANSPLANT

This patient, a woman of fifty-nine years, fell ten days ago, sustaining an intracapsular fracture of the neck of the femur. Several years ago, in connection with operative surgery on the cadaver, I worked out a plan of incision to be followed in operations for the reconstruction of the hip-joint, which is as follows:

The incision begins 1 inch below and a little external to the anterior superior spine, and is carried backward to a point just above and behind the great trochanter, and then downward on a line corresponding to the posterior surface of the femur (Fig. 163). I am following this plan in the case before me. The incision is now carried through the tensor fascia femoris, and by separating the fibers of the gluteal muscles as nearly as possible the incision comes down on the neck and finally the great trochanter, which is the landmark used for approaching the capsule of the hip-joint. The difficult feature about this whole operation is the depth at which it is necessary to work without introducing the hands into the wound. I am now opening the capsule of the joint on its anterior part. A bloody fluid is escaping with a few fragments from the neck. By referring to the accompanying *x*-ray picture it is readily seen that this is a comminuted fracture (Fig. 164).

Now by holding the split portion of the capsule open one is able to see the torn portion of the capsule dipping down between and separating the bony fragments. The pathology presented here shows how difficult it would be to get bony union without an open operation. I want those near the operating-table to see how the capsule lies between the fragmented ends of the bone. I have now lifted the torn portion of the capsule from between the bony segments. With a lion-jawed forceps on the great trochanter I am able to rotate it forward sufficiently to bring the head of the bone in line with the fractured neck. The periosteum just below the great trochanter on the external surface is removed, and with a long electric drill, especially made for this purpose, I am making an opening through the compact portion of the femur to allow me to make the remainder of the groove through the cancellated portion of the neck with the Murphy doweling instrument, as the groove through this portion of the bone is made more accurately with the hand-driven instrument than with the electric drill. As soon as the instrument passes

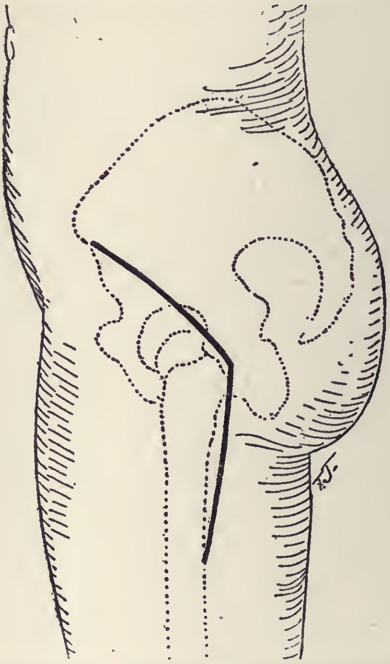


Fig. 163.—Incision for exposure of the hip-joint.

the line of fracture into the head, you will note the head is fixed upon the shaft just as I wish to fix it with the bone transplant. The groove is now well up into the head of the femur and ready for the reception of the graft. The length is 4½ inches, which I will now mark on the skin of the tibia of the same leg.

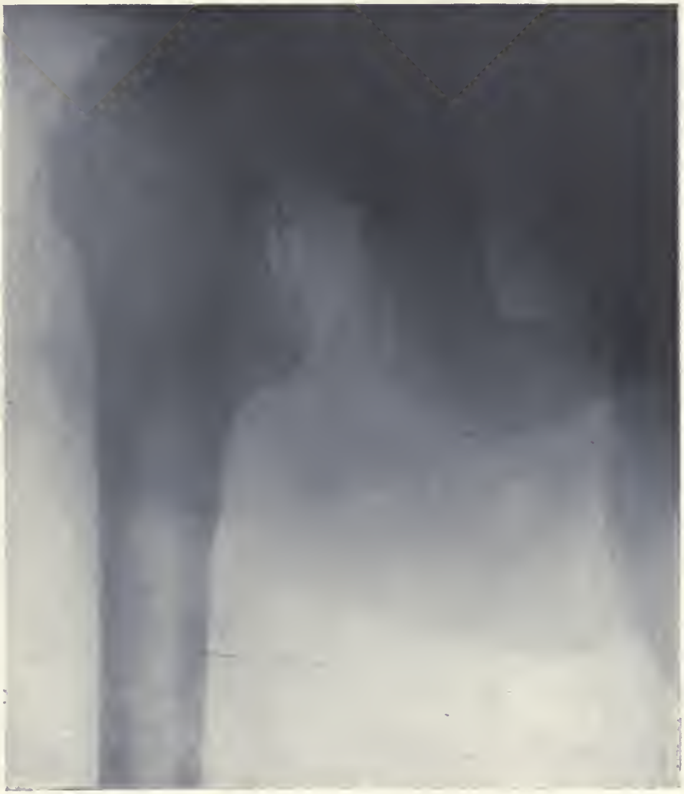


Fig. 164.—Comminuted fracture of the neck of the femur before operation.

An incision 7 inches in length is now made over the subcutaneous part of the tibia and the skin edges well retracted. A transplant 4½ inches in length by ½ inch in width down to the marrow is now taken. This transplant will fit the groove made in the head of the femur rather snugly, which is the condition I wish to produce, as that will secure the head more tightly to the neck of the femur. I am now driving the transplant into the prepared bed, and you will notice that it goes up nicely into place. The transplant is now in place. I am retracting the capsule so that you may see the head moving with the femur, which fits very solidly in place. All points of bleeding are tied off. The capsule is now closed with chromicized catgut. The muscles are allowed to come together with a few mattress stitches of catgut. The tensor fascia femoris is now closed. The skin is closed with chromicized catgut and the wound dressed as in the previous case, much dressing being placed over the trochanter and over the site from which the tibial transplant was taken.

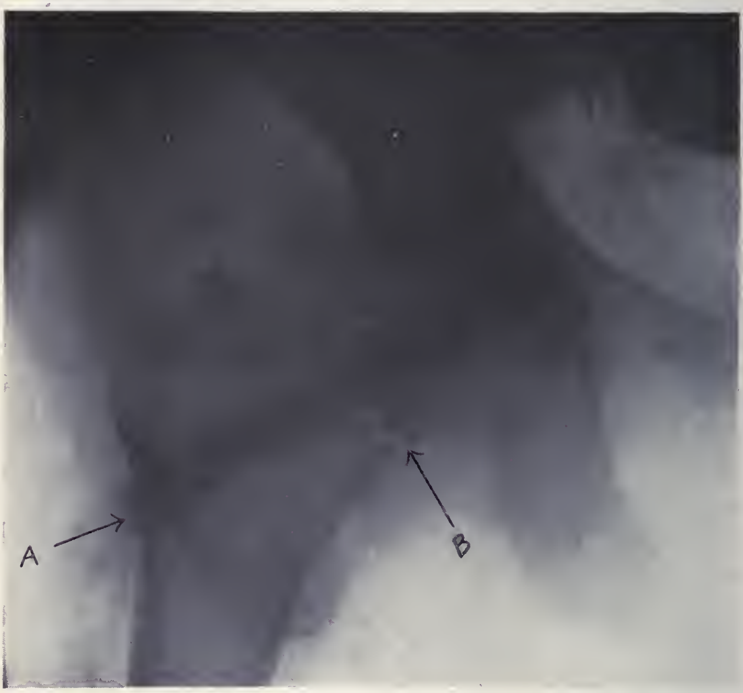


Fig. 165.—Complete reduction of the fracture. *A*, The autogenous tibial transplant holding the head in place (note that the greatest width of the transplant has been put in the vertical position, as in this position it supports the greatest carrying weight). *B*, Line of fracture.

We are now removing the patient to the *x*-ray room in order that an x-ray picture may be taken before applying the cast. The limb is now thrown into a well abducted position by means of a traction apparatus and dressed in this position with a plaster-of-Paris dressing. The cast over the leg is split within three hours from the time it is applied. The accompanying x-ray picture, which has now been developed, shows a perfect reconstruction of the neck of the femur (Fig. 165).

CASE III.—TUBERCULOSIS OF THE FIRST PHALANX OF THE SECOND FINGER

This is a case of tuberculous osteomyelitis of the shaft of the first phalanx of the second finger. The disease is of two years' standing, with lateral sinuses communicating directly with the skin surface, as is well shown in the lateral view of the finger in the accompanying x-ray plate (Fig. 166, *A* and *B*).

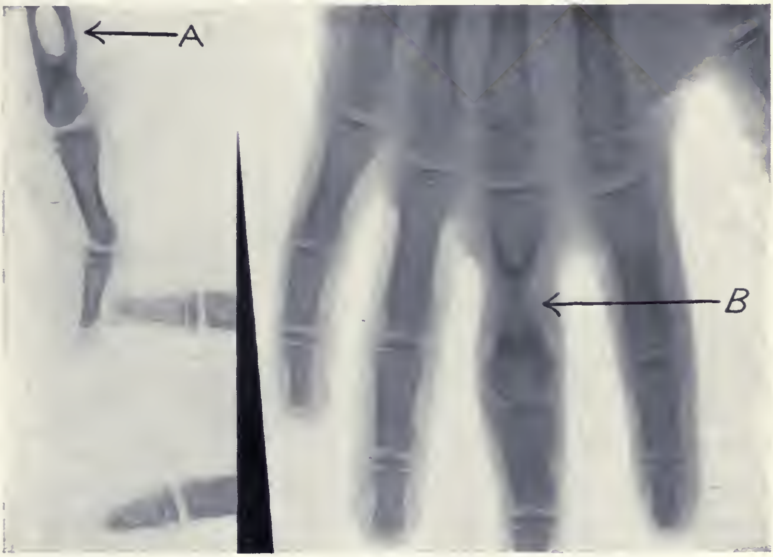


Fig. 166.—Tuberculous osteitis. *A*, Side view. *B*, Anteroposterior view.

Against the generally accepted rule, which forbids the transplantation of bone into an infected region, I am carrying out the transplanting plan, owing to the fact that it seems the only practicable way of splinting this finger and thereby preventing contracture. The same plan of technic is followed as in the previous cases. The incision is made over the dorsal surface of the affected part and then carried down upon the bone. The skin is well retracted. The bone is removed at a safe distance on either side of the disease. As shown in the accompanying *x*-ray plates, enough of the shaft is left at either end so that I am able, by means of a Murphy doweling instrument, to place the intramedullary bone splint into place without injuring the epiphysis (Fig. 167).

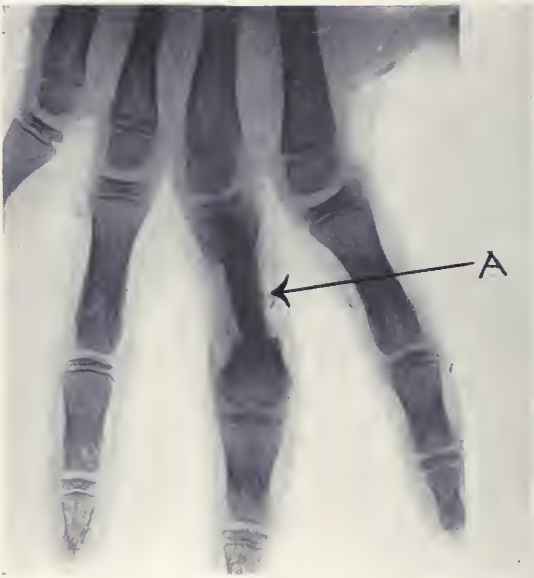


Fig. 167.—Transplant, two and a half months after operation, completely healed in.

I am now removing the autotransplant from the left tibia. It is $1\frac{1}{4}$ inches in length and $\frac{1}{4}$ inch in width and thickness. It is made with a small shoulder on each end, which will slip up against the corresponding portion of the shaft of the phalanx. You see how nicely this splints the finger. The wound is now closed and dressed on a single splint for this finger, in order that the sinuses on either side of the finger may be dressed from day to day. This case will be watched and the result reported at a later date.

January 25, 1917.

I wish to demonstrate the following cases which have been operated on within the last few months so that we may see the results of the operations.

CASE I

The first case is that of tuberculosis of the first phalanx of the middle finger operated on November 6, 1916. The sinus which was present at operation cleared up after several weeks' treatment. The case is presented today with the accompanying skiagrams which show the progress that has been made. It will be noted by examining the *x*-ray plate (Fig. 168) that new bone is being laid down between the shaft and the transplant at each end and about the entire transplant. The interesting fact in this connection is the presence of the original

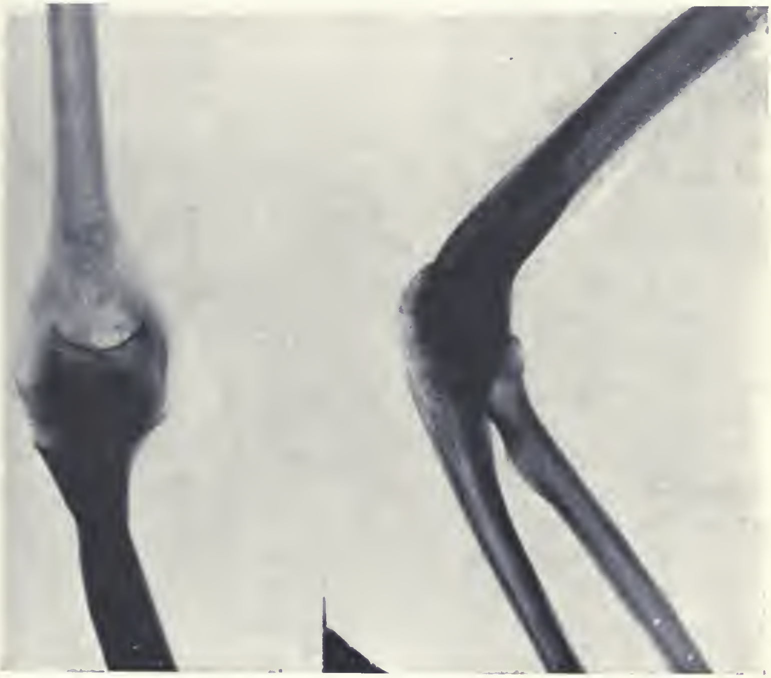


Fig. 168.—Complete bony ankylosis. Before operation.

transplant still intact and taking the place of the former shaft of the bone throughout, showing that the transplant at least temporarily acts not only as a bridge-work for the new bone but also as a supporting shaft, as is shown by the stability of this finger. The movements of the finger are practically the same as in any of the other fingers of that hand.

One other interesting feature in connection with the transplantation of bone into this infected area which, as I said before, was carried out because there was no other plan by which this finger could be splinted and contracture prevented, is that autotransplants may have a greater tolerance for infection than we originally supposed. This patient has been asked to report to the *x*-ray department every month for the next year in order that a study may be made of the growth of bone within the transplant.

CASE II.—ARTHROPLASTY FOR ANKYLOSIS OF ELBOW

Patient, a young woman twenty-five years of age, married two years. Ankylosis is of Neisserian origin. The operation was performed four and one-half months after the ankylosis began.

In connection with the general plan of arthroplasty I am of the opinion that in those cases where the etiologic factor is the Neisserian type of infection it is well to do the operation fairly soon after the ankylosis begins. I base this opinion upon the fact that there is not the same tendency for recurrence of the infection, since the culture-medium necessary for the growth of this organism is synovial surface, and since this is entirely destroyed by the disease itself and removed during the time of operation, there does not seem to be the same danger of lighting up a latent infection that there might be in an ankylosis with other forms of organisms as the etiologic factor. Any one who has had any great amount of experience with fractures and dislocations of the joints knows how rapidly, especially in the elbow-joint, contractures of the surrounding soft parts take place and how distressing they are to manage. It has occurred to me that if it is possible to perform the operation of arthroplasty before this contraction in the soft tissues about the joint is complete, much time and pain would be saved in reestablishing the normal range of motion to the joint. In two recent cases of this type operated on in this clinic the results have been so good as to make me an enthusiastic believer in early operation on ankylosed joints where Neisserian infection is the etiologic factor in producing the ankylosis.

The accompanying drawing (Fig. 169, 1 and 2) shows the method of making the flap. The internal flap has its base above the internal condyle, with the line of incision as shown in the drawing, and its posterior edge running down, taking the fat and fascia covering the pronator radii teres, the flexor carpi ulnaris, the palmaris longus, and flexor carpi radialis. In other words, the entire flexor group of the hand which originates from the internal condyle. Great care must be exercised in removing the fascia overlying these muscles in order to minimize the amount of trauma to the muscles themselves. The external flap is made with the base downward, and is taken from the fascia overlying the upper part of the supinator longus. This is a short flap and is utilized only to cover the head of the radius. After making the incision the ulnar nerve is exposed and very carefully retracted to one side by means of gauze, and the bone removed by means of an arthroplasty chisel. Enough bone between the sigmoid fossa and the condyles of the humerus is removed to give a centimeter's space, and a corresponding amount of bone is removed between the synovial surface of the external condyle and the head of the radius. The tip of the olecranon is removed in order that extension may be made complete. This amount of space is sufficient to permit the long internal flap, already described, to be placed over the internal condyle, pulled through over the external condyle, and attached to the external fascia over the external condyle, as shown in Fig. 169. The base of the internal flap, in addition to covering the internal condyle of the humerus and the articular surface of the olecranon process, is also used to form a fascial sheath for the ulnar nerve, thereby protecting the nerve from injury in the healing process of the joint. The external flap is now tucked around what remains of the head of the radius,

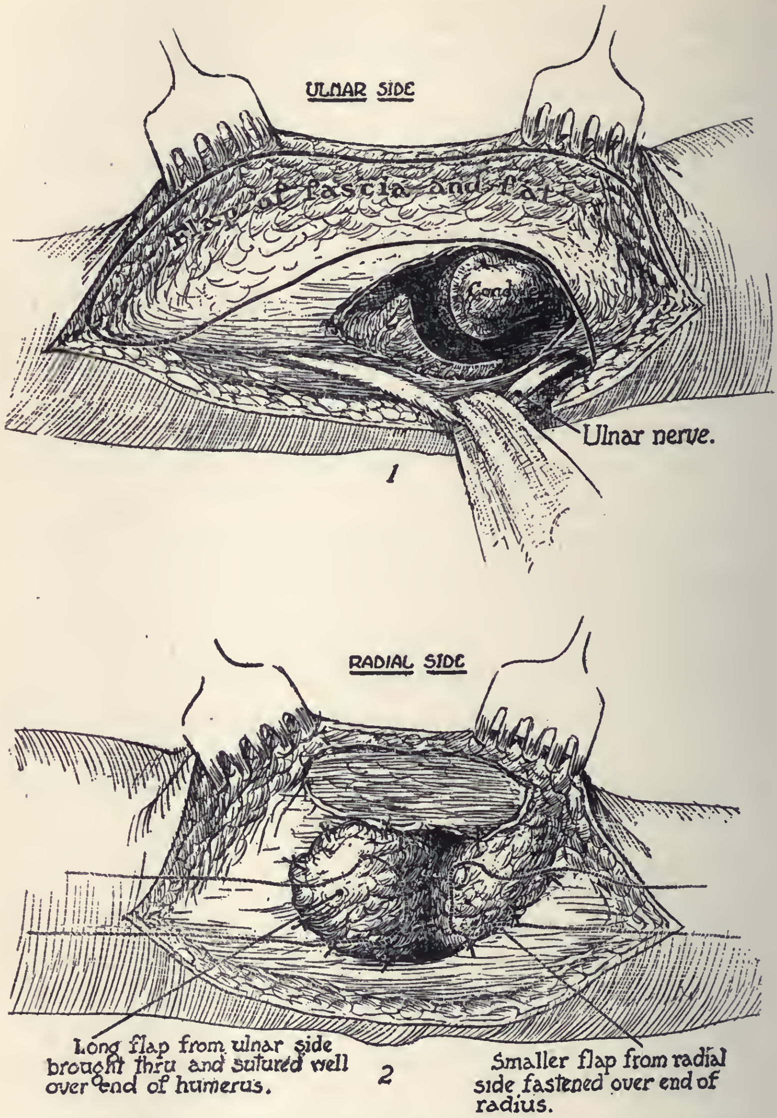

ULNAR SIDE
Flap of fascia and fat
Condyle
Ulnar nerve.
1
RADIAL SIDE
Long flap from ulnar side brought thru and sutured well over end of humerus.
2
Smaller flap from radial side fastened over end of radius.

Fig. 169, 1, 2.—Source and arrangement of flaps in arthroplasty on the elbow.

and the tip of this flap is attached in the depth of the wound to the internal flap which has already been put in position. This is shown in Fig. 169, 2.

The wound is closed in the ordinary way and dressed in extension with an ordinary 5-pound weight. Slight passive movements are begun about the seventh or eighth day, and these movements are kept up daily, encouraging at the same time active movements until the patient is able to control the movements of the arm.

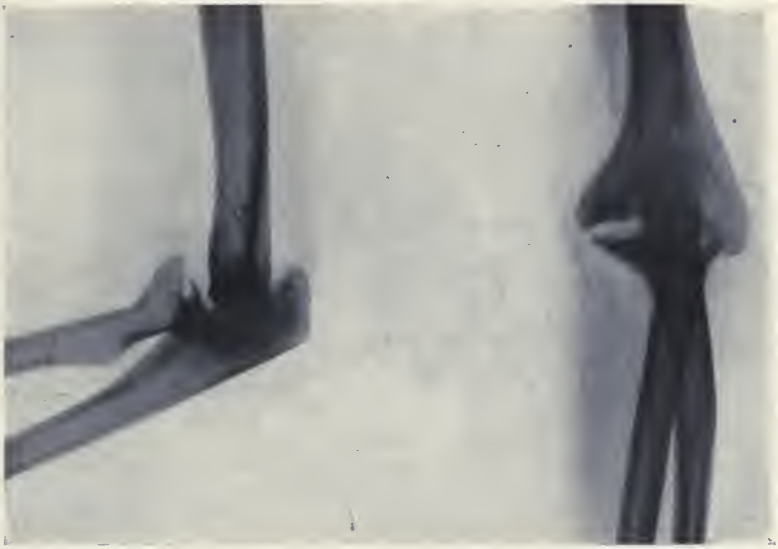


Fig. 170.—Several months after operation. Normal mobility.

This patient is presented today in order to show the amount of extension and flexion she possesses. You see that the range of motion is practically normal; she is able to put her thumb on her shoulder, which shows the degree to which flexion has been obtained. Extension is practically as complete in this arm as in her left. The patient is able to do practically as much with this arm today as she was before the disease occurred. (Compare Figs. 168 and 170.)

CASE III.—DOUBLE DISLOCATION OF THE SHOULDER

Mrs. B., aged twenty-three years. This is a case of double dislocation of the shoulder following what is reported to have been an epileptic seizure. The interesting fact in connection with this case is the occurrence of these dislocations without the history of a fall or a sudden jerk on the hyperabducted arm, such as we usually get. The dislocations are apparently the result of muscular action. Case was reported to me four months after this condition occurred. Upon examination there was found the characteristic signs of a downward dislocation of both shoulders into the axillary space, with marked atrophy of the deltoid muscles. In fact, the diagnosis of dislocation was made because of the disturbance in these muscles. The accompanying *x*-ray pictures, taken before the patient was operated on, show fracture of the anatomic neck (probably pathologic fracture) and marked atrophy of the heads of both bones. Figure 171, *A* shows the vacant glenoid cavity on the right side and Fig. 171, *B* the same condition on the left side.

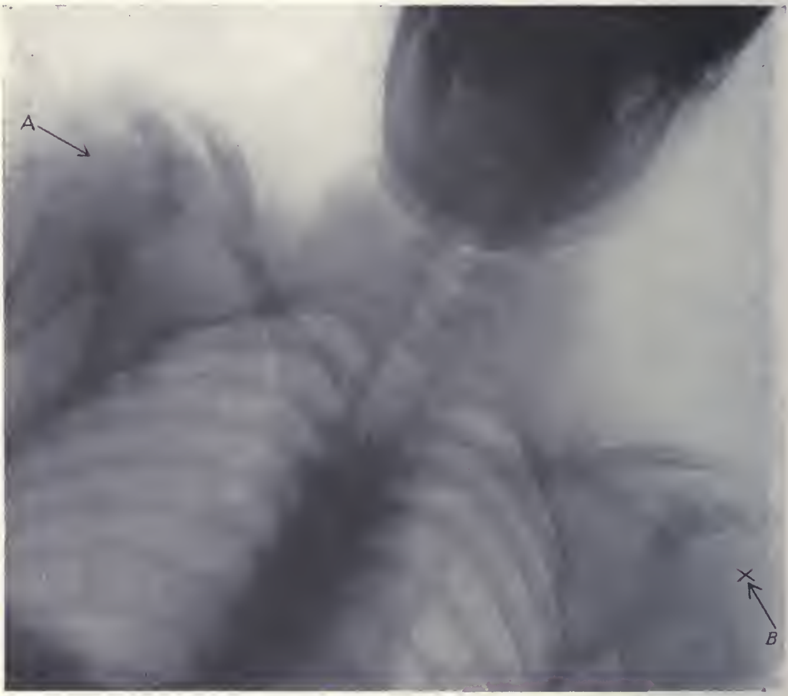


Fig. 171.—*A* and *B*, Vacant glenoid cavity on right and left sides respectively.

Owing to the fact that the degeneration was more marked in the head of the right humerus than in the left, and because of the hope of giving the patient some service in her right arm, it was decided to operate on that shoulder first.

On opening what remained of the capsule of the joint the head was found devoid of circulation, a type of dry necrosis having occurred. The head was soft and resembled very much a dead gourd that is found in the garden in summer, which when you compress it crumbles and breaks. In fact, the synovial portion of the head of the humerus was so soft and crumbled so easily that I felt very positive that, whether I took it out or not, the patient was going to have a flail joint. If it were left

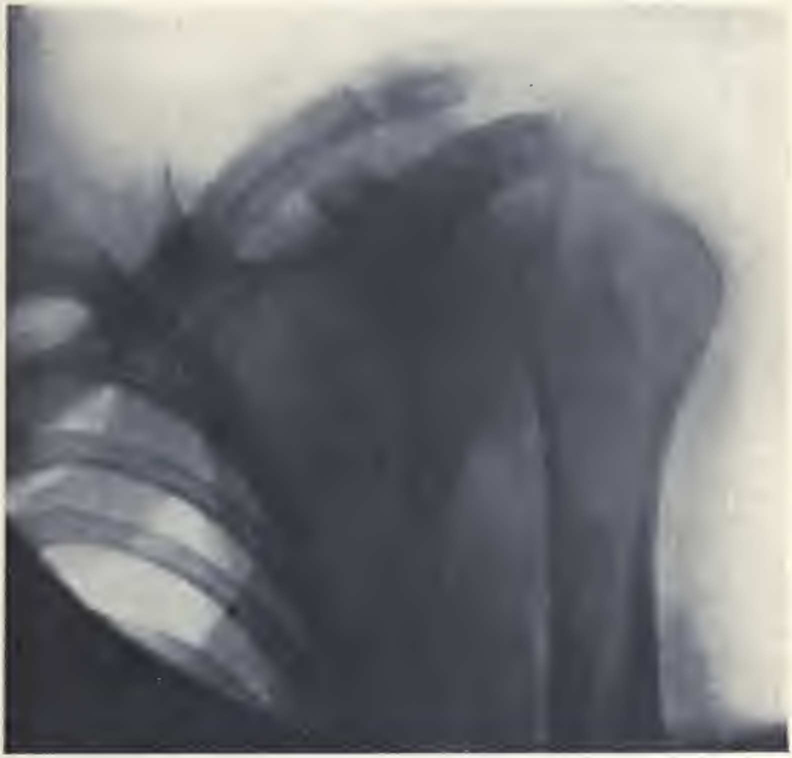


Fig. 172.—Degenerated head of humerus immediately after reduction.

in it would very likely produce a sinus and continue to discharge necrotic bone until the head was resected. It is known that when a bone is out of its normal position sufficiently to disturb its blood-supply, degeneration takes place; while if it is replaced before degeneration is complete, the added nourishment may be sufficient to cause marked regeneration.

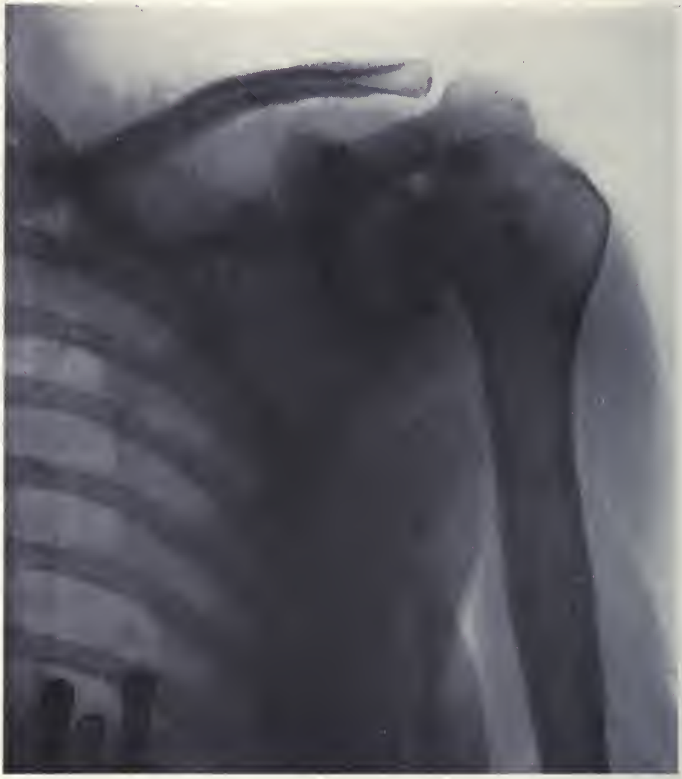


Fig. 173.—The same joint: marked regeneration of the head of the humerus four months after operation.

Following the instructions laid down by Dr. Murphy, it was decided to manipulate the head as little as possible, and return it to what remained of the glenoid cavity by attaching what remained of the capsule to the under surface of the glenoid. This held the head very well in place. The capsule was then brought together, the wound closed, and the patient dressed in the ordinary way (Fig. 172). Slight movement was started within two weeks. The accompanying *x*-ray pictures show the degree to which regeneration has taken place, and the function of the arm as displayed by the patient shows a shoulder practically as serviceable as that possessed by any ordinary individual. Figure 173 shows the marked regeneration of the head four months after operation.

The left shoulder was not operated on until one month after the right, and was found to be a much more difficult problem to handle because of the formation of fibrous tissue and the contraction that had taken place. The adhesions were so firm that it was nearly impossible to get the head, which had been broken and healed out of position, back into anything like its normal position. This also has given a very good result, and while there is some deformity owing to the fracture of the anatomic neck of the humerus, it is nevertheless a very good-looking shoulder, and she is able to use the left arm very nearly as well as the right.

The interesting feature about this case is the fact that the head of the humerus placed back in its normal position seems to have regenerated.

CASE IV.—FRACTURE OF THE HUMERUS: BONE TRANSPLANT

Mr. V., carpenter, sixty-four years of age, came to me five months after his original injury, which occurred in falling off a scaffolding. The entire head of the humerus, as shown in the accompanying *x*-ray picture (Fig. 174), was markedly atrophic. The upper end of the shaft was comminuted, and at that time what remained of the surgical neck pointed outward and upward, with a great deal of absorption and degeneration of the head of this bone. A false joint had formed between the side of the surgical neck and the broken distal end of the shaft.

After explaining to the patient the possibility that if we operated we might fail to obtain union because of his age, he was still desirous of having the operation performed because the use of both arms was necessary in the performance of his work. An autotransplant from the tibia into the upper end of the shaft of the humerus was made. At operation the head of the humerus was found to be soft and degenerated. The transplant was 5½ inches in length by ¼ inch in width and ¼ inch in thickness. The head was found to be so soft that we were unable to hold it with the transplant placed in the groove made with the doweling instruments, and consequently it was necessary to put on a light Lane plate. The accompanying

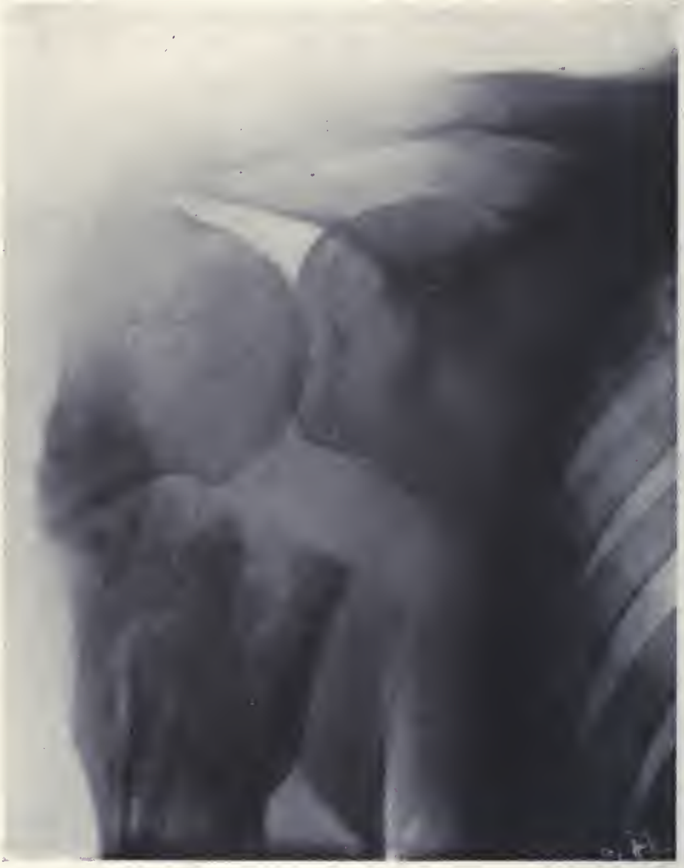


Fig. 174.—The position of the head and shaft of the humerus before operation.

röntgenograms show the position of the head and shaft of the bone before operation (Fig. 174). The next picture (Fig. 175) shows the transplant in place and the new bone bridging the defect.

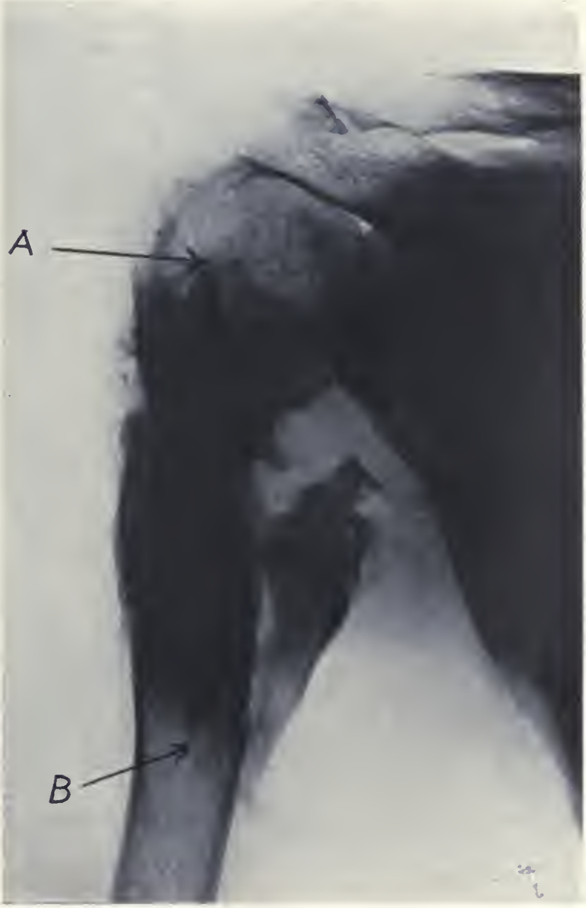


Fig. 175.—After operation. At *A* and *B* are seen the upper and lower ends of the transplant.

The patient was discharged from the hospital within three months of the time of operation, and at that time started doing light work which required the use of both arms. This he continued to do for eighteen months, until December 20, 1916, when he fell and injured this same arm, and is here today in connection with the dressing of this recent injury. A röntgenogram (Fig. 176) taken a few days before his last injury shows how completely the fracture has healed and the head of the humerus has regenerated.

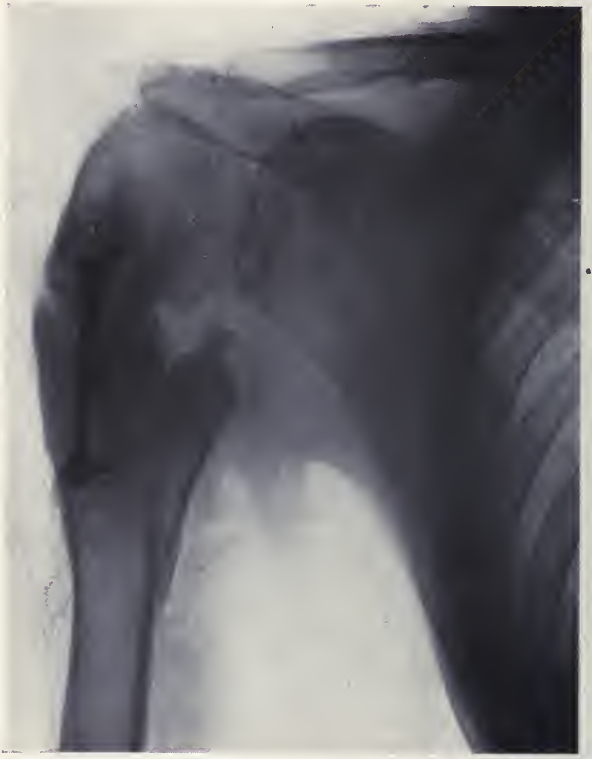
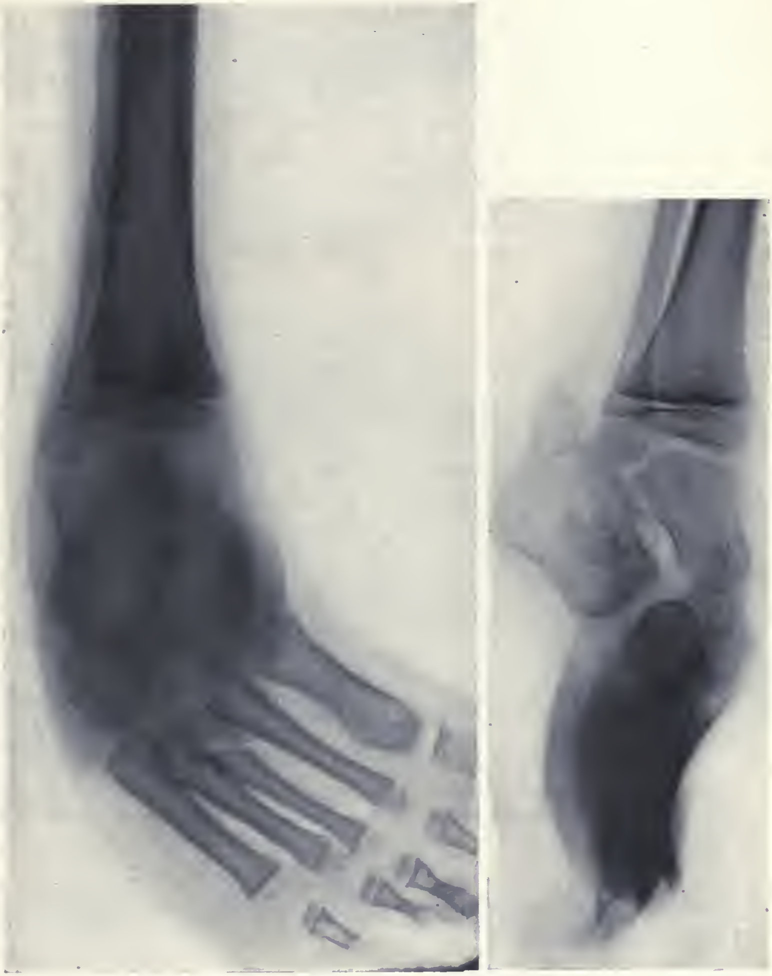


Fig. 176.—Röntgenogram taken a few days before last injury shows how completely the fracture had healed and the head had regenerated.

CASE V.—CONGENITAL ABSENCE OF SCAPHOID: REPAIR BY BONE TRANSPLANTATION

M. M., a boy of six years, came to the hospital with a marked deformity of the left foot and leg, an atypical talipes equinovarus. This patient apparently had been neglected in his



Figs. 177, 178.—Before operation. Note the entire absence of the scaphoid and the dislocation forward of the outer end of the astragalus with an exostosis growing out of posterior surface of os calcis at the site of attachment of tendo achillis.

early life, no attention being paid to his condition, so that when he presented himself at the hospital he hobbled along on his right foot, working his left with the heel forward and the dorsum of the foot turned under and backward.

Upon examination, as shown in the accompanying *x*-ray plates (Figs. 177 and 178), we noted the following deformities: First, an entire absence of the scaphoid bone and a dislocation forward of the outer portion of the astragalus; second, an exostosis growing out of the posterior surface of the os calcis at the original site of attachment of the tendo achillis.

The contractures were first treated by lengthening the tendo achillis, severing the plantar fascia on its mesial aspect, transplanting the outer half of the tibialis anticus into half of the peroneus brevis tendon, and at the same time shortening what remained of the tendon of the peroneus brevis. A cast was then applied, holding the foot in an overcorrected position to rectify the varus of the foot and the contraction due to the shortening of the tendo achillis.

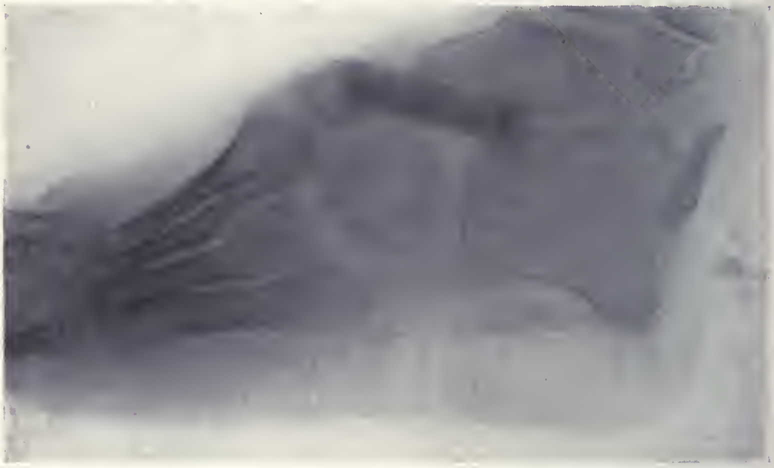


Fig. 179.—Congenital absence of scaphoid. Röntgenogram made one month after operation. Lateral view of transplant placed in space which should have been occupied by the scaphoid.

After several months in this position the patient was prepared for operation. A transplant $1\frac{1}{4}$ inches in length by $\frac{1}{4}$ inch in width and thickness was taken from the crest of the tibia and placed in the position made vacant by the absence of the scaphoid. The transplant was placed in a groove made by removing the periosteal surface of the anterior aspect of the os calcis and the periosteum of the posterior surface of the internal cuneiform bone, which was held in position only by the superimposed fascia.

The patient is now presented, five weeks after operation, with a fairly normal looking foot. The transplant, as shown in the accompanying *x*-ray pictures (Fig. 179 lateral view, and Fig. 180 anteroposterior view), has formed a supporting bony structure on the inner aspect of the foot and the shortened tendons have tended to hold the remainder of the foot in place.

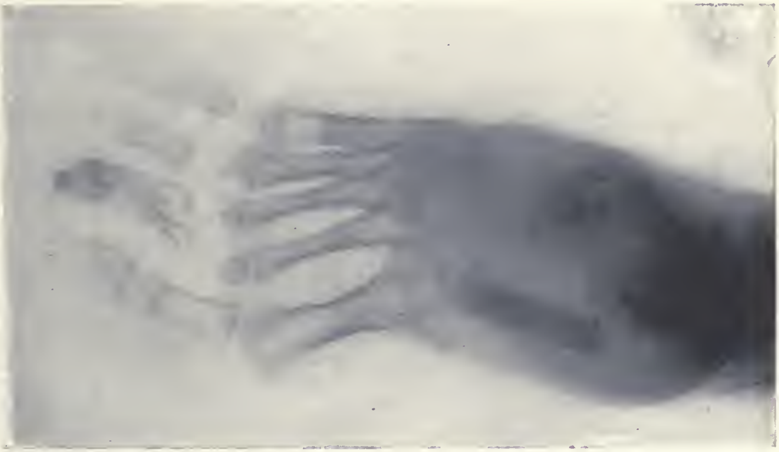


Fig. 180.—Congenital absence of scaphoid. Anteroposterior view one month after operation.

The difficulty we encountered in this case came in attempting to place the astragalus back into its normal position on the lower end of the tibia, but you will note in Fig. 180 that the astragalus is in fair position. This case is presented especially because of the transplantation of a piece of bone from the tibia into the space just described, and will be watched with a great deal of interest, *x*-ray pictures being made every month. In that way we can estimate the fate of the autotransplant. A law has been laid down in connection with the reconstruction of bone to the effect that if an autotransplant is placed in contact with two living osteogenetic centers regeneration takes place. It will be of interest clinically and scientifically to note whether this transplant will absorb or continue to grow into a new bone because of the function placed upon it, substituting in a space made vacant by the congenital absence of the scaphoid.

CLINIC OF DR. FREDERICK G. DYAS

COOK COUNTY HOSPITAL

OPEN TREATMENT OF INFECTED WOUNDS

Summary: Dakin's solution; Wright's solution; type of wounds in which they are desirable and how to use them; illustrative case; open treatment of burns—2 cases; theory and results of the method.

October 28, 1916.

WE have 3 cases for demonstration today. They will give you some idea of the results obtained by the so-called open treatment of infected wounds. The closed method of treating wounds has been considered an economic necessity and has been carried on from the earliest times, but the present war has emphasized the fact that this old method of wound treatment is entirely inadequate. The infections in wounds received on the battlefields during the present war are of exceptional virulence. As a result it has been found necessary to abandon the methods used in the Boer, the Spanish-American, and the Russo-Japanese wars, the only wars that have been fought since the advent of the science of bacteriology, and to return in a measure to the procedures of the pre-antiseptic days with one noteworthy addition. During the Franco-Prussian War all infected wounds were opened as widely as possible and kept open. Today we irrigate these widely opened wounds either with Dakin's solution or with Wright's physiologic solution. Dakin's solution is made as follows:

Dissolve 140 grams of dry sodium carbonate in 10 liters of water; 200 grams of chlorid of lime are added to this. The mixture is then filtered through a plug of cotton, and to this are added 40 grams of boric acid. This solution is good for use up to one week. After that time it is not to be used.

Coincident with the coming out of Dakin's solution came Wright's famous article on the "Physiological Treatment of

Infected Wounds." He considered the treatment of wounds under three headings: First, the anatomic method; second, the physiologic method; and, third, vaccine or serum therapy. The physiologic method consists in making the freest possible incisions, leaving the wound widely open to the air and sunlight, with a thorough use of a so-called "lymphagogic" solution. This solution consists of equal parts of 5 per cent. sodium chlorid and ½ of 1 per cent. of sodium citrate. Its purpose is to keep the pus from coagulating, thereby promoting drainage. Wright had previously demonstrated that normal salt solution produced an active local leukocytosis and that a 5 per cent. salt solution caused less active leukocytosis. A solution of salt not as strong as a normal salt solution produced no active leukocytosis. This solution was called "lymphagogic" solution because Wright was able to demonstrate an increased flow of lymph from the tissues and a preservation of the fluid state of the wound secretions, and thereby a continuous washing out of the wound under its influence. This solution is used, as is Dakin's solution, not in the time-honored manner of wet dressings, but by continuous or interrupted irrigations and by immersion in baths. It is incumbent upon us when treating infected wounds to discard any dressing which dams back discharges or macerates tissues. These pitfalls are avoided when using the open method by careful regulation of the amount of irrigation and the duration of the baths. By the use of Dakin's solution many of the most intensely infected wounds, the type for which it is especially designed, become clean in from four to ten days. (Note chart from Dr. Carrel incorporated in Clinic by Dr. Carl Beck, p. 143 of the February, 1917, number.—Ed.) As soon as evidences of sepsis have disappeared, the solution is discontinued and the edges of the wound coapted by strips of adhesive plaster or by skin clips. In dressing our wounds a cradle is placed over the wound surface and mosquito netting is draped over the cradle to prevent infection by flies (Figs. 181 and 182). Contamination by atmospheric air we have proved to our own satisfaction is negligible.

As an example of the practical use of Dakin's solution let us

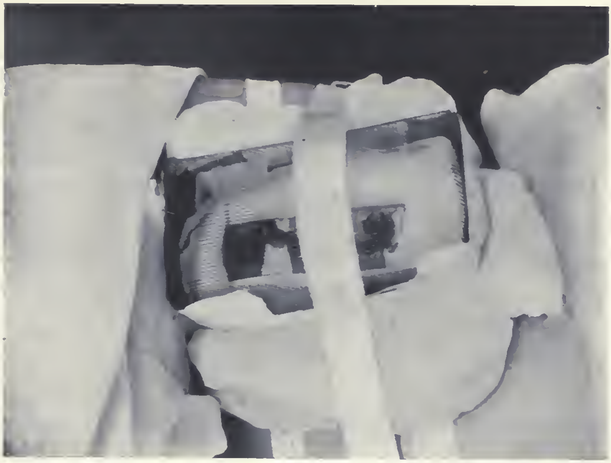


Fig. 181.

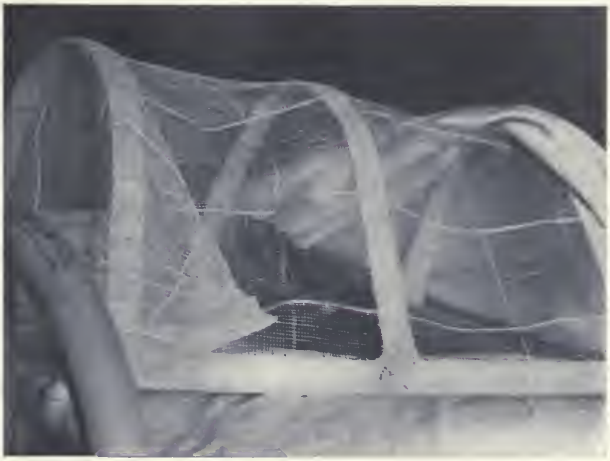


Fig. 182.

Figs. 181, 182.—Open treatment of infected wounds. The wounds lie exposed to the air, protected only by a coarse wire screen or a piece of mosquito netting supported by a framework made from barrel hoops. Fig. 181 infected appendectomy wound. Fig. 182 infected wound of foot.

consider the case of this man who was admitted to the hospital on Sept. 23, 1916, presenting a severe cellulitis of the leg. The history we get is that one week prior to his admission he came home from work complaining of general malaise. The same night he had a chill which lasted almost all night and his temperature was very high. He thinks that once it reached 105° F. The next day all the pain localized in the right leg, which gradually became swollen and inflamed. He called in a physician, who made an incision on the median surface of the leg and expressed a little pus. Since then it has been about the same.

His past history is unimportant and he denies venereal history.

At the time he came in the right leg was markedly swollen and reddened from above the knee to below the ankle, pitting on pressure, and in many places there was a blistering of the skin, but no definite localization of the pus. An incision about 1½ inches long was made and a gauze drain inserted. Subsequently other incisions were made and the pus expressed and drainage-tubes introduced, and later on the tissues on the median side of the calf of the leg all sloughed off, the muscles of the calf hanging loosely through the open wound. There were large masses of necrotic tissue that kept up a foul discharge through the sinus and there was marked inflammation about the internal malleolus.

The wound was then treated by the open method which we have just described. You can see how these muscles herniated through the skin incision. This was a horrible, stinking, necrotic mass. It looked as though it would be necessary to do an amputation. We began treatment with Dakin's solution. An upright was erected at the foot of the bed, and on top of the upright a receptacle holding about 1 quart of the solution was placed and connected by a rubber hose with the rubber drainage-tubes which went through this leg. By this arrangement we were able to maintain at will either a continuous or an interrupted irrigation. We chose the interrupted—four times a day at first and now twice a day. The muscles were held up, as you see, by adhesive plaster, which was the only covering of the wound. He had no pain at all with this method of treatment. He has not been subjected to the discomfort of having the dressings taken off every day, and he is going on to a complete recovery, except that he will probably have to have some skin-grafting in order to cover over that denuded area.

I wish to show the next 2 cases as examples of another type of infected wound which is also best treated without the direct application of dressings.

This patient, a man of thirty-two years, a laborer by occupation, came into the hospital on October 3, 1916, complaining of extensive burns of his back and legs.

One week previous to admission, while sleeping near an open fire, his clothes caught fire and some minutes elapsed before he could throw the clothes off. He felt some pain for a few days, but he was able to walk; he even slept on his back. On the fourth day he went to bed and has been in bed ever since.

The family history is unimportant, as is the venereal history.

Examination showed an extensive burn from about the level of the middle of the scapula down to the posterior aspect of the knee-joints. In spots there were islands of normal skin quite intact. In other places an eschar, which has since been removed, In other places there was no evidence of skin forming underneath, but there was a light granulating surface.

He was treated, as you see, by the open method. The bedclothes are kept away from the wound by a cradle, as in the first case. The crusts have been removed and the burns irrigated with a weak solution of aluminum acetate, merely as an astringent wash. I have asked him from day to day if he were in pain and he has replied in the negative. He has been spared the torture of the frequent changing of dressings applied to that surface and is progressing very favorably. His wounds may in some places require skin-grafting, but I think most of them will heal over.

You remember we were taught in out text-books of surgery that where one-third of the cutaneous surface of the body is burned, death is likely to occur, even though that burn be superficial. That was true with the old methods of treatment, but does not hold good with the present methods of the open treatment of burns. Now you can see how clean that area is. His temperature is normal, pulse 80, and his general condition is good. His leukocyte count is 10,200. The urine is negative. The intern says that some of these wounds have already healed.

Our next patient is a Lithuanian twenty-four years of age. He came in on October 14th with first and second degree burns of the hands and face, but no one has been able to ascertain how he received them.

They were handled just as in the previous case. One striking point confronts us as we look at these wounds, namely, their perfect cleanliness. There is no evidence of pus. As I stand close I cannot get the faintest odor of suppuration. His temperature is 98° F. and his pulse 72. He is not getting any absorption or he would have an elevation of temperature, because to us, as clinicians, temperature can only mean one thing, namely, absorption of the products of infection. As I have told you so often, do not deceive yourself by thinking the patient has a temperature because he has had too many visitors or because he has sat up a little too long. That does not give him a temperature. Fever is always the result of the absorption of the products of infection. That is the only safe rule for you to follow as clinicians. If we were able to interrogate this man—he speaks no English—we would find that he is not suffering any pain.

It is a source of considerable gratification to me that I published my first article on the open method of treatment, as illustrated in these burn cases, before it was published in Europe. The method is right and there is no arguing against it when one has once seen the results. The factors which led to the trial of this method were the following:

Infection of wounds depends upon the growth of bacteria therein. In order that they may develop, bacteria require three things—warmth, food, and moisture. If deprived of a sufficient degree of any one of these elements, growth becomes impossible. The open treatment of wounds, as exemplified in these burn cases, is based on the above fact. We cannot refrigerate the wound, because by so doing we injure the tissues; the tissues themselves afford the pabulum for the bacteria, therefore it is impossible to attack them from the standpoint of their food supply; the degree of moisture, however, we can decrease, and this is best done by complete exposure of the infected surface to the air, and, preferably, to a current of air such as might be produced by an electric fan. Superficial wounds, such as these burns, may be dried out in this way and be rendered practically aseptic.

One of the earliest advocates of this method of treating burns was Sneve, of Minnesota,[1] who tried it in a series of 85 cases. Sneve summarized his experience as follows:

"When first seen burns and, more particularly, scalds are apt to prove deceptive as regards their degree, and it is wise to withhold prognosis in the beginning. Whenever occlusive dressings are kept on, even for forty-eight hours, I am confident that these will frequently convert a first into a second and a second into a third degree burn through confinement of the perspiration and maceration of impaired tissue. One of the remarkable things in this experience with burns is the small amount of pain suffered by the patients and its short duration when the wounds are left exposed to the air. Severe pain, when not obscured by shock, only lasts from six to twelve hours, and I think is better controlled by hypodermics of morphin than by any other measure. I would urge that as little morphin be given as possible; it should not be given when shock is present.

"Another astonishing feature is the character of the cicatrices after healing. In burns of the second degree the skin is reproduced so well that only a white color marks the scar. Third degree burns result in smooth, flexible, skin-like scars." (Sneve has adopted a classification of burns according to which hyperemia of the skin is considered first degree; destruction of the epidermis shown by vesiculation, second degree; destruction of the derma, third degree; and of the deeper tissues, fourth degree.) "Two factors probably account for this: First, the top of granulations which grow into the meshes of the dressings are not torn off day by day, forming scar ridges throughout the substance of the scar, which firmly anchor the skin covering and probably interfere with its nutrition; and, second, nature seems better able to control the growth of the firm, small, healthy granulations which result from exposure to the air—a marked contrast to the large flabby efflorescent masses seemingly growing without direction in the moist chamber of an occlusive dressing. The length of time for skin to cover a wound, judging from Wagner's and my own observations, is shortened about two-thirds, as compared with the time required under occlusive dressings. Wagner[1] estimates that a normal granulating surface the size of a saucer can be healed over in from eight to ten days.

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[1] Jour. Amer. Med. Assoc., 1905, xlv, p. 1.

"First, treat the shock as indicated above (warm baths, room at high temperature, abundant saline per rectum, and by hypodermoclysis combined with judicious use of adrenalin).

"Second, control the pain as necessary, and keep everything from contact with burned areas.

"Third, keep the patient surgically clean. Ordinary surgical principles govern here as elsewhere; bichlorid of mercury, carbolic acid, and other strong antiseptics are to be avoided when possible, because they are such powerful cell poisons that toxic effects, both general and local, are to be feared; the delicate covering of granulations will not stand escharotic action without interfering with the production of smooth, flexible scars.

"Fourth, give frequent cold spray baths to the sound skin, with friction, and keep room temperature high.

"Fifth, cut away all blisters, cleanse with normal salt solution, dry thoroughly, and dust all second degree burns with stearate of zinc, carefully wiping away serous exudate until dry, brown, adherent crusts are formed.

"Sixth, leave third degree burns exposed without powder and keep surface clean until granulations are ready for skin-grafting.

"Seventh, to maintain and to preserve function, body and limbs should be exercised as much as possible; the eschars of burns of fourth degree should be removed when nature so indicates, and amputation should be performed when needed."

In the main, I agree with Sneve; I believe, however, that irrigation with a 2 to 5 per cent. solution of aluminum acetate after removal of the crusts represents an advance over the Sneve method, and that the use of an electric fan at a rate of speed sufficient to maintain just a perceptible current over the exposed lesions may be of value in some cases. In addition, severe burns in the neighborhood of joints may at times require special handling to prevent contractures.

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[1] Zentralblatt f. Chir., Dec. 12, 1903.

SURGICAL CLINICS OF CHICAGO

Volume 1 Number 3

CLINIC OF DR. ARTHUR DEAN BEVAN

Presbyterian Hospital

PULSION DIVERTICULUM OF THE ESOPHAGUS—CURE BY THE SIPPY-BEVAN OPERATION

Summary: Pulsion and traction diverticula of the esophagus; mechanics of their production; signs and symptoms of esophageal diverticulum; danger of confusing with stricture—how to differentiate; treatment; dangers and sequelæ of the older operations; technic of the Sippy-Bevan operation; the after-treatment.

I desire to show you a very interesting case which has been referred to my service by Dr. Bertram Sippy with the demonstrated diagnosis of pulsion diverticulum of the esophagus. As you know, there are two forms of diverticula of the esophagus—the pulsion and traction diverticula. The first, the pulsion, is the one that interests surgeons a great deal, while the traction diverticula are surgically of but little interest. They are usually well down in the thorax and are the result of a contraction of scar-tissue about the esophagus, especially chronic inflammatory processes, such as tuberculosis in the mediastinal glands. By this contraction the esophagus is deformed and a portion of the wall pulled outward, forming a diverticulum. Usually the defect is not great and does not require surgical treatment; as a matter of fact it is, as a rule, not amenable to surgical treatment.

Pulsion diverticulum occurs constantly at the same point, just as does an inguinal hernia. This is true because there is a weak point in the esophagus or, rather, at the junction of the esophagus with the pharynx, as represented in the plate which I show you (Fig. 183), where there is a divergence of the muscular fibers, leaving a small triangle uncovered by muscle, and where the mucous membrane and submucosa can, under pressure, be forced out as in a hernia. In the process of deglutition a good deal of pressure is brought to bear upon the walls of the esophagus and pharynx, and sometimes, at this weakened point, the tissues give and a hernial projection gradually develops, sometimes forming a pouch the size of an egg, or sometimes a pouch that will hold, in extreme cases, a half-pint or a pint or more of fluid (Fig. 184).

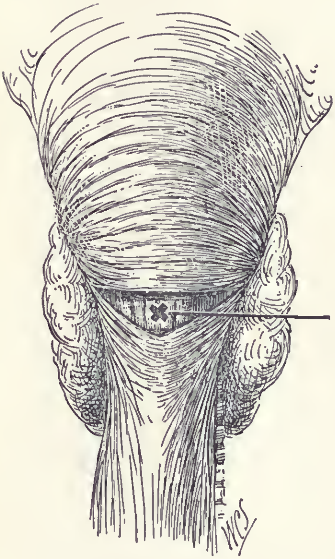

Fig. 183.—Weak spot in posterior wall of esophagus at about the level of pharyngo-esophageal junction, marking the site of all pulsion diverticula of the esophagus.

The clinical picture is a very striking and sometimes a very distressing one. When the pouch is small, little or no difficulty may arise. As it increases in size, however, a considerable amount of food passes into it and decomposes, producing marked irritation, and is regurgitated. As the pouch enlarges, it tends to encroach more and more upon the esophagus, and eventually conditions may arise such that, after the pouch is filled with food, it is impossible for the patient to get anything through the esophagus into the stomach. In extreme cases these patients die of starvation. The diagnosis can be made by the history of difficulty in swallowing and regurgitation of food and liquids; sometimes food is retained for some time in the pouch, and when regurgitated shows marked evidences of decomposition. When the diverticulum is large and filled with food one can sometimes see a swelling in the neck which rises and falls with deglutition. When the diverticulum contains food or liquid and air, succussion sounds may be elicited, just as in a stomach partly full of liquid and partly full of air. On passing a sound the sound usually goes into the pouch and is stopped at the bottom

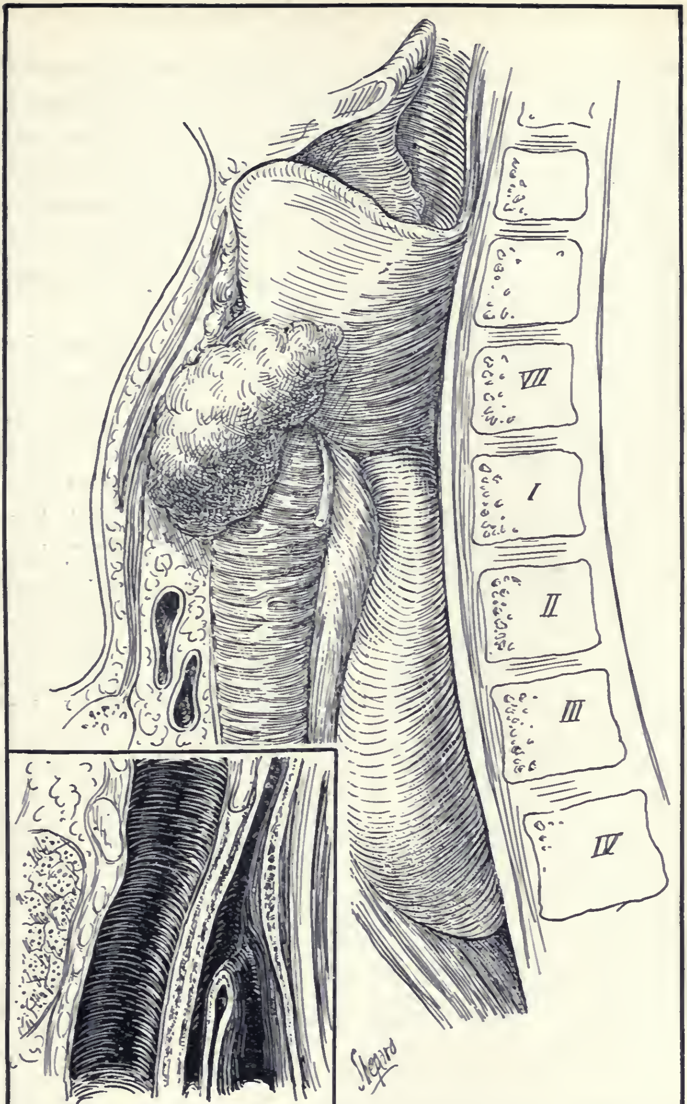

Fig. 184.—Diagram illustrating the location of esophageal pulsion diverticula with especial reference to the mechanism of pressure-occlusion of the esophagus when a diverticulum becomes distended with food. Insert: Sagittal section of esophagus at point at which diverticulum arises. The mouth of the diverticulum may exceed the esophagus in circumference and may lie in the direct line of the esophageal lumen so that everything introduced into the esophagus passes directly into the diverticulum and is regurgitated, thus simulating clinically a complete obstruction.

of the pouch, leading often to the diagnosis of stricture of the esophagus. If, however, the patient swallows a string, a large bougie can be threaded over this string and passed through the esophagus without difficulty, showing that no stricture exists. A graphic demonstration of the diagnosis is made by having the patient swallow a barium or bismuth meal and then taking an *x*-ray picture. This will show clearly the outline of the diverticulum filled with barium solution.

Many of these cases have been operated upon, and in the early history of these operations the mortality was extremely high. An improved technic, however, has reduced this mortality considerably, but still the operation is one that carries a good deal of risk: first, because it is often done when the patient is weak and emaciated from partial starvation; second, because many operations are followed by pneumonia; third, because many of them are followed by local infection, which may lead to mediastinitis, general infection, and death. Within the last few years I believe that we have in this clinic improved the operation for this condition by the development of a technic which I shall use in this particular case.

This patient is in very good general condition and is a good surgical risk. I shall do the operation under a general anesthetic. In some of our cases the patients have been so weak or so nearly dead from starvation that it has been necessary to do a gastrostomy first and feed the patient for some weeks before undertaking the operation. Where the patient is not a good surgical risk I think the operation should be done under local anesthesia. This we have done very satisfactorily.

TECHNIC OF OPERATION

I shall make a long incision over the sternocleidomastoid of the left side from the clavicle to the angle of the jaw (Fig. 185). This divides the skin, superficial fascia and platysma, and the deep fascia. The sternocleidomastoid is now drawn to the outer side and the omohyoid muscle comes into view. In this case, as you see, this is a broad muscle. I shall clamp it with two clamps and divide between them. Now I expose the thyroid gland and the covering of the trachea, and find a large artery crossing the esophagus to reach the posterior surface of the thyroid gland. This is the inferior thyroid artery, and I very carefully isolate it, clamp it at two points, divide between the clamps, and ligate each of the cut ends. This enables me to push the thyroid medianward, while with a blunt retractor I carry the carotid artery and internal jugular vein laterally and expose the upper part of the esophagus. With a blunt dissecting forceps I now pick up the upper part of the diverticulum, using great care not to rupture it. Arming my fingers with a piece of gauze I gradually draw this large sac up out of the thoracic cavity and into our field. You see that this dissection has to be

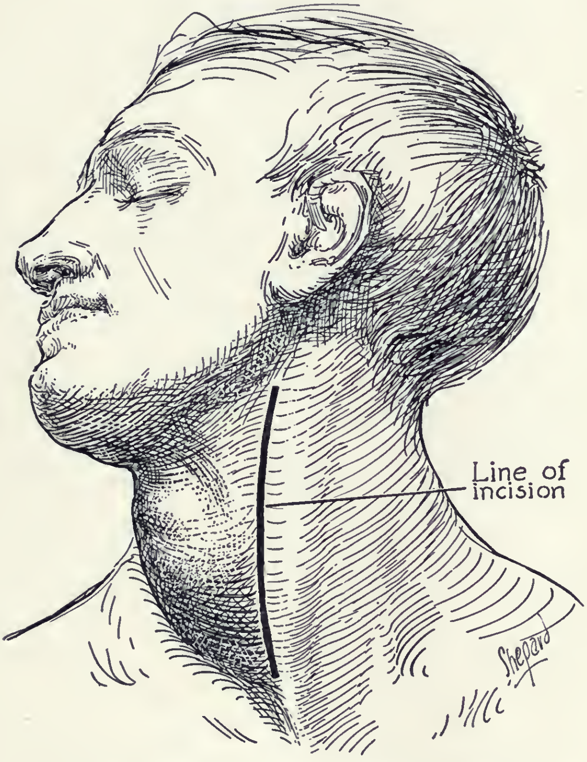

Fig. 185.—Location and extent of incision and necessary dissection for exposure of diverticulum.

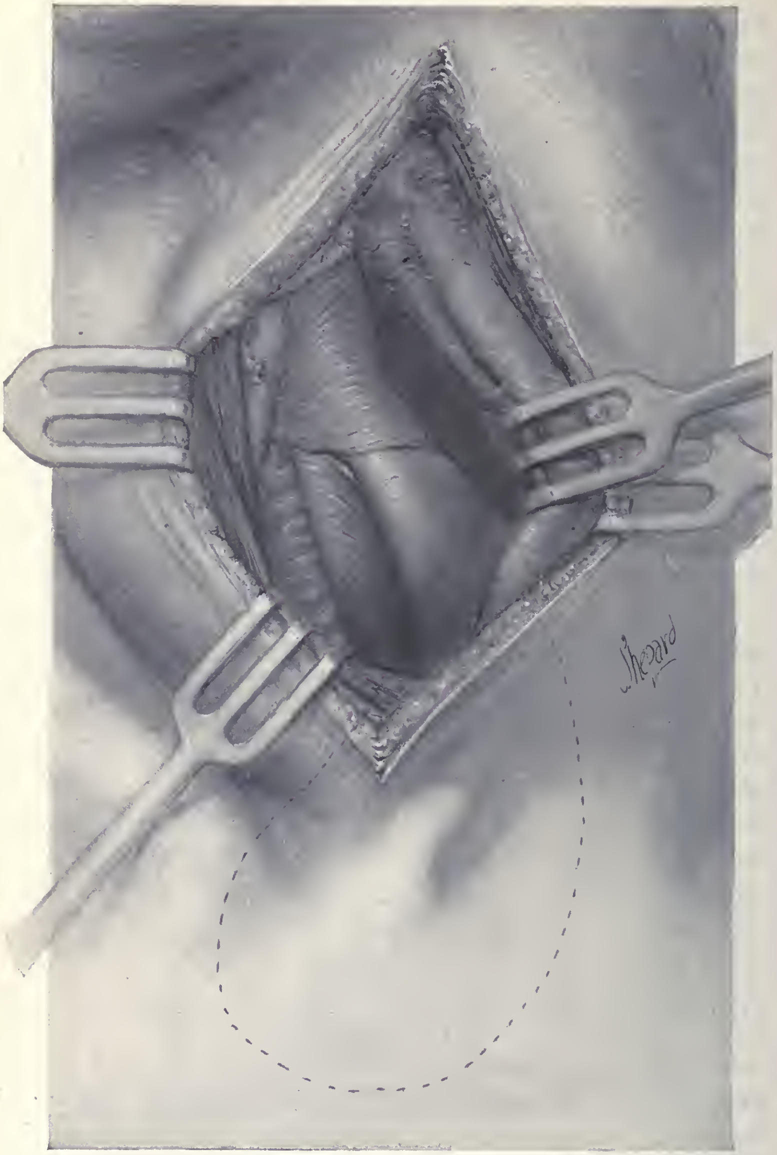

Fig. 186.—Location and extent of incision and necessary dissection for exposure of diverticulum.

made very carefully, and it has required in this case fully eight or ten minutes to free the sac and bring it completely out of the wound. I show you a large sketch of this part of the dissection in (Fig. 186), which you see in this chart. The sac is composed of mucous membrane and submucosa and has no covering of muscularis.

In the early history of these operations a number of schemes for obliterating the sac were tried. All of them involved cutting off the diverticulum and sewing up the opening thus made with several rows of sutures. It was found, however, difficult to secure a closure which would not permit subsequent leakage. The condition is very different from that which is met in sewing up an intestine, because here there is no peritoneal covering to produce a plastic exudate and so secure repair. The result was that many of these early operations were followed by leakage, infection, and death; or, if the patient recovered, with either a temporary or a permanent fistula. On that account a variety of methods of treating the sac have been advocated. One in which the sac is drawn up out of the wound with or without being twisted, and stitched into the upper angle of the wound, is most to be commended. This leaves a fistula which may be cured by a second operation, but it protects the patient against infection due to leakage in the mediastinum, and is to be preferred to the earlier methods of simple extirpation of the sac and suture. The plan which we have developed in this clinic might properly be called the Sippy-Bevan operation, because it was at the suggestion of Dr. Sippy that I first performed it and because of Dr. Sippy's insistence that, if possible, the sac should not be opened, but dealt with in some way which would prevent leakage into the surrounding tissues of the neck. With that purpose in view in the first case that I operated on I isolated the sac as I have done in this case, and obliterated it by a series of purse-string sutures (Fig. 187). I am using for this purpose linen which has been vaselined so that it will run more smoothly in the tissues and lessen the risk of tearing through the sac—a little point in the technic which I wish to emphasize. You will see that I am carefully obliterating this sac by these purse-string sutures and invaginating the sac into itself and the esophagus. In this case I have used four purse-string sutures, the first three being of linen and the last one of iodin gut. I am doing this because the three linen sutures will be passed into the esophagus eventually, and the last purse-string suture of iodin gut will, of course,

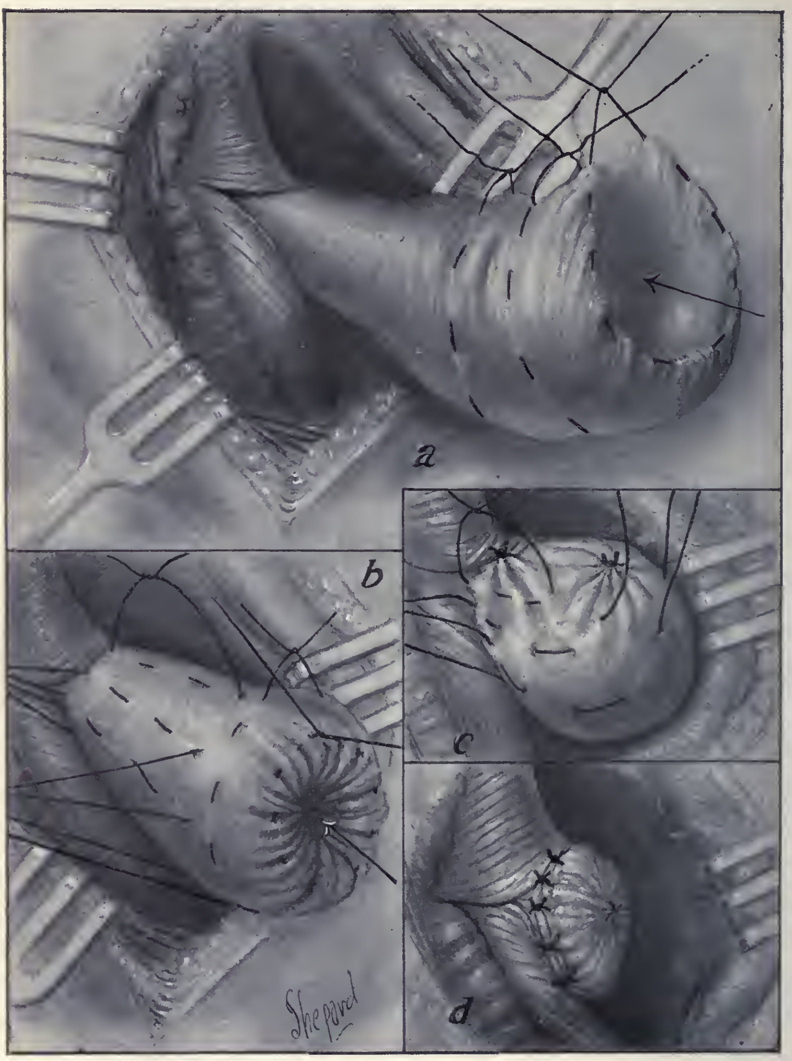

Fig. 187.—Sippy-Bevan operation for cure of diverticulum of the esophagus.

be absorbed and produce a firmer cicatrix. Depending upon the size of the sac we may either handle it with these purse-string sutures alone, or in case the sac is so large that if it were all inverted into the esophagus it would produce an obstruction, we may obliterate about two-thirds of the sac with these purse-string sutures and then put in five or six longitudinal sutures, as you see represented in Fig. 187, *b*. The resulting picture is a complete obliteration of the sac, as shown in Fig. 187, *d*.

We have now obliterated the sac entirely. We have repaired the divided omohyoid muscle, and we close the deep fascia with fine catgut sutures and the external wound with black linen without any drainage.

The after-management of these cases is exceptionally important, and consists in giving the patient liquid by rectum for the first twenty-four hours and later by feeding him through a small rubber tube passed through the esophagus into the stomach, or into the esophagus well below the point of the diverticulum.

I desire to present to you, as the best method of handling these pulsion diverticula, both large and small, the technic which I have adopted in this case.

REMOVAL OF MURPHY BUTTON FROM STOMACH TWO AND ONE-HALF YEARS AFTER GASTRO-ENTEROSTOMY FOR DUODENAL ULCER

Summary: A patient with transient recurrent attacks of vomiting associated with severe abdominal pain; importance of the *x*-ray, especially of fluoroscopy, in locating the cause of the symptoms; rôle of the Murphy button in gastric surgery.

The second case which I want to present to you this morning is this patient on whom we recently operated. This is another case in which the *x*-ray was of great value in making the diagnosis.

This man came to me a few weeks ago with the statement that two and one-half years before he had been operated upon by the late Dr. John B. Murphy for duodenal ulcer. He made a splendid recovery from the operation and was very greatly improved, gaining in weight and strength, and considered himself entirely cured until some weeks ago, when he had a sudden severe attack of pain in the abdomen associated with vomiting which lasted for some hours. He recovered rapidly from this attack, but since that time has had several other attacks.

On obtaining his history I could find nothing determinable as to the cause of the symptoms until the *x*-ray pictures disclosed a large oblong Murphy button low down in the abdominal cavity. It seemed to occupy a position in the pelvis. My first impression was that it was caught in some way in the sigmoid. I turned the patient over to our roentgenologist, Dr. Roundtree, and told him that I wanted him to determine the location of this button. Dr. Roundtree's demonstration was very conclusive. He first gave the patient a barium meal in front of the screen, and with the first splash of barium in the stomach the button disappeared, showing that the button was in a very low-lying stomach.

A small incision was made above the umbilicus, and with very little difficulty the stomach was explored, and the portion containing the button was drawn outside of the abdominal incision. A clamp was placed on the stomach below the button and quite a small incision sufficed to enable us to push the narrow end of the button out of the stomach. The wound in the stomach was closed in the usual way by three rows of sutures (Fig. 188).

The exact way this button produced the symptoms is difficult to explain. I am rather inclined to believe that it was caught in the gastro-enterostomy opening, and so blocked up the opening in the jejunum as to produce obstruction with resultant pain from overdistention of the stomach, and vomiting; that then the button worked back into the stomach and the obstruction was relieved. Murphy was for some years my colleague in this clinic, and I do not think that any of us can overestimate the great service that he rendered to abdominal surgery by the introduction of the Murphy button. The Murphy button was used as the means of safe anastomosis with which the first extensive gastro-intestinal work was done. Such men as the Mayos and Mikulicz did their first large series of successful gastro-enterostomies with the Murphy button. It demonstrated to the surgical world the safety of these operations. It proved later to be one of those devices that belong to the developmental stage of surgery. I think it has served its purpose splendidly, but that it now has a limited field of usefulness and that our gastro-enterostomies are today done better by the use of a needle and thread than by the use of any mechanical device, even such an ingenious and efficient device as the Murphy button. It should, however, be retained in the armamentarium of the operating surgeon because occasions do arise where the rapid anastomosis permitted by the Murphy button proves life-saving. In this connection I want to say that the particular case which I show you this morning is illuminating because it probably explains why some of the cases, operated on in an attempt to find the Murphy button before the days when we had developed *x*-ray examination to the present stage of efficiency, failed. I remember one case in the hands of my colleague, Dr. Christian Fenger, in this clinic, very similar to

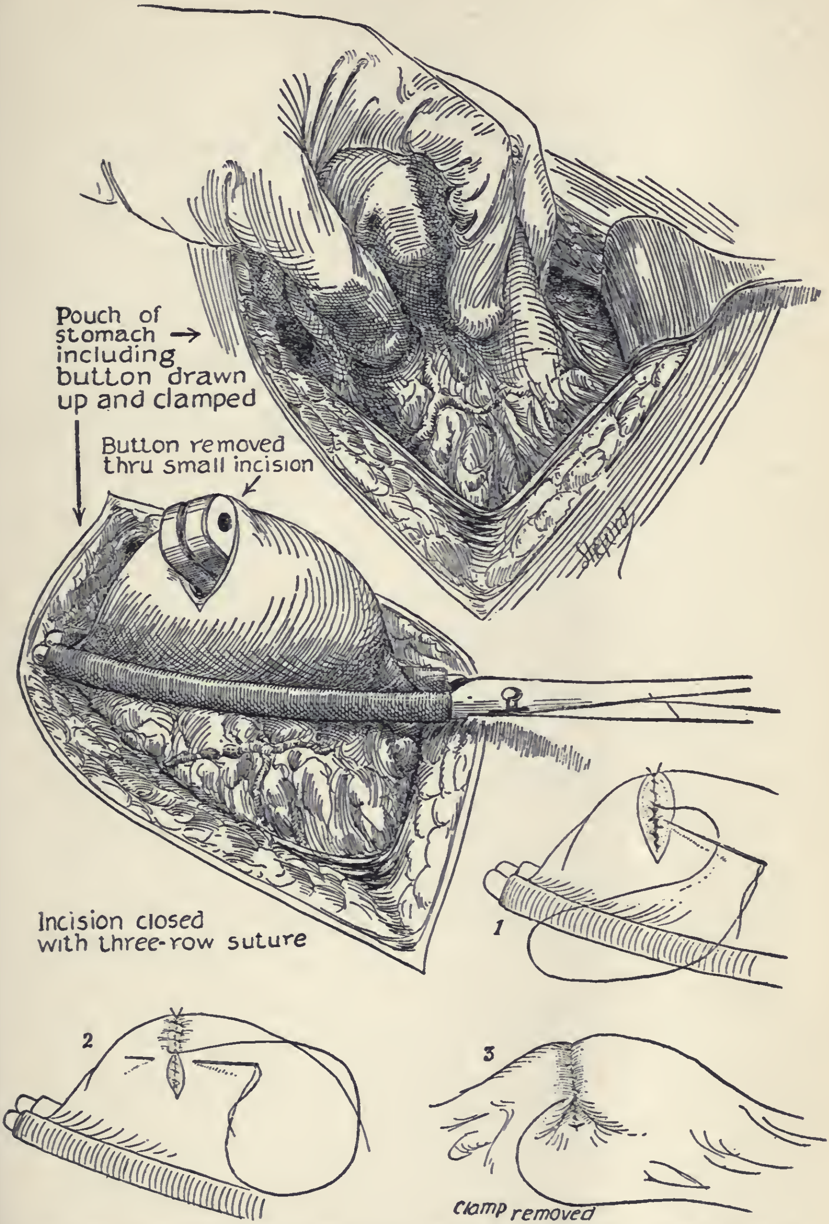
Pouch of stomach including button drawn up and clamped
Button removed thru small incision
Incision closed with three-row suture
1
2
3
Clamp removed

Fig. 188.—Removal of Murphy button from stomach and technic of closure of gastric incision by three-row suture.

the one which I present this morning, in which he found exactly the same picture. In the *x*-ray the button was low down in the pelvis. He interpreted the findings as showing that the button was in the intestinal tract, and made a most careful search of the entire intestinal tract without finding the button. I am inclined to think that it must have been loose in the stomach as in this case, and that a barium meal would have demonstrated that fact without any difficulty. In Fenger's operation he made a low incision, and I do not think he seriously considered the possibility that the button might have been in the stomach.

The patient whom I am now showing you made a good recovery from the operation, and his convalescence has so far been uninterrupted. He sat up on the third day, and there has been no recurrence of the symptoms.

HERNIA OF THE DIAPHRAGM

Summary: A case in which the entire transverse colon and great omentum lay within the thoracic cavity; pre-operative diagnosis made by *x*-ray. Technic of curative operation; classification, etiology, and diagnosis of diaphragmatic hernias.

I HAVE the opportunity of showing you this morning one of the most interesting cases that has presented itself in this clinic for a number of years.

The patient, Mrs. L. O., is a woman of forty-one, whose chief complaints are those of constipation and loss of weight and strength. She felt quite well until five years ago, when she commenced to have recurrent attacks of heart-burn coming two or three hours after meals, associated with belching of sour material, and made worse by coarse foods, vegetables, and fruits. During the past few weeks the patient has had three or four attacks a week and has vomited. She has sometimes vomited quarts of material which, however, has never been bloody or coffee-ground; she has never felt any evidence of peristalsis in the abdomen. She has gradually lost ground in the last six months, and during this period has lost 30 pounds in weight. She has been constipated for years. Has never, as far as she knows, had blood or mucus in the stools.

When she came to the hospital a fluoroscopic examination of the stomach and duodenum after a barium meal showed a small amount of retention. The stomach was large and there were very vigorous peristaltic waves. A small stream of barium could be seen passing through the duodenum, but there was no duodenal cap. A possible diagnosis of duodenal ulcer was considered, and the patient put on ulcer management. She improved somewhat under this, and left the hospital after a short time.

She returned, however, in a short time complaining of still further loss of weight and of crampy attacks in the upper abdomen. Since leaving the hospital the patient has been on careful ulcer management and has aspirated her stomach daily. When she went on two-hour feeding she noticed a tendency to nausea and had to aspirate herself three or four times a day. She then went on hourly feeding. When she aspirated her stomach she obtained from 1 to 4 pints at a time. She has been confined to bed at times during the past two months.

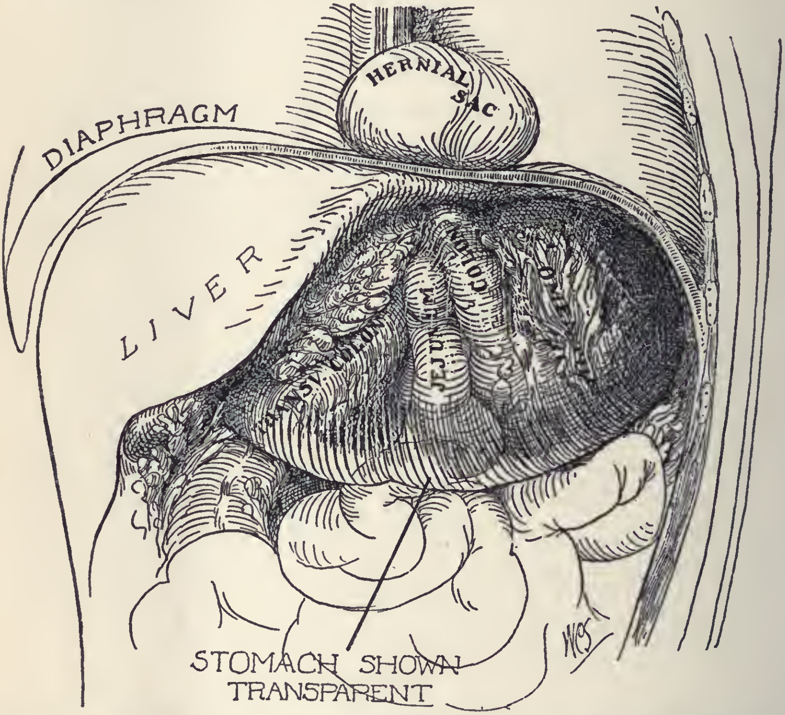

Fig. 189.—Hernia of transverse colon and omentum through diaphragm by way of lesser peritoneal cavity.

She feels weaker and has lost an additional 10 pounds, but has none of the previous burning in the epigastrium.

Another fluoroscopic showed no retention, but very active peristaltic waves. Finally the colon was distended with a barium injection. This showed a most interesting condition, as is shown in the diagram (Fig. 189), of a diaphragmatic hernia of the colon, which Dr. Sippy believed occupied a position behind the stomach in a large sac in the thoracic cavity. After this diaphragmatic hernia was discovered, we obtained from the patient a history of a fall down the entire length of a flight of stairs four years before. She fainted at that time and it is possible that this traumatism may have had something to do with the development of the hernia, although this is simply suggested as a possibility.

Operation.—I shall operate upon this patient under ether anesthesia. An S-shaped incision is made on the left side from the xiphoid to the level of the umbilicus and a very large free opening of the upper left abdomen obtained. On entering the peritoneal cavity a very singular picture is found. The stomach comes into view and under the stomach are coils of the small intestine. The great omentum and transverse colon are nowhere to be seen (Fig. 189). On introducing the hand behind the stomach the fingers enter a large opening in the diaphragm capable of admitting three fingers of the right hand. A large cavity can be felt above the diaphragm containing the entire omentum and transverse colon, part of the ascending colon, and part of the descending colon. These structures are drawn down into the abdominal cavity very carefully, although in doing this the great omentum is torn in one place and bleeds. This tear is repaired by suture.

After reducing the hernia the left hand is placed on the anterior surface of the stomach and the stomach drawn downward. The edges of the large incision are held apart with retractors, and a very large esophageal opening three or four times the normal size is brought into view. When the patient breathes the air rushes into the cavity above the diaphragm with much the same sound that is made when one puts a large drainage-tube into an empyema cavity, and the air rushes in and out of the pleural cavity during respiration. As is shown in the diagram (Fig. 190), this large opening is sewed together with good-sized catgut, just as we would sew the internal oblique and transversalis to Poupart's ligament in closing an inguinal hernia. The crura of the diaphragm are very large and muscular, so that we can take a good ½-inch bite with the needle, and such an excellent exposure is obtained with our large incision that we can readily do this without injuring any of the vessels in the diaphragm. The opening is closed so as to leave simply enough room for the esophagus. The closure is so complete that I do not think that it is necessary to stitch the omentum or transverse colon to the abdominal wall in order to prevent a recurrence. We shall close this large incision without any drainage. The head nurse informs me that the pads and sponges are all ac-

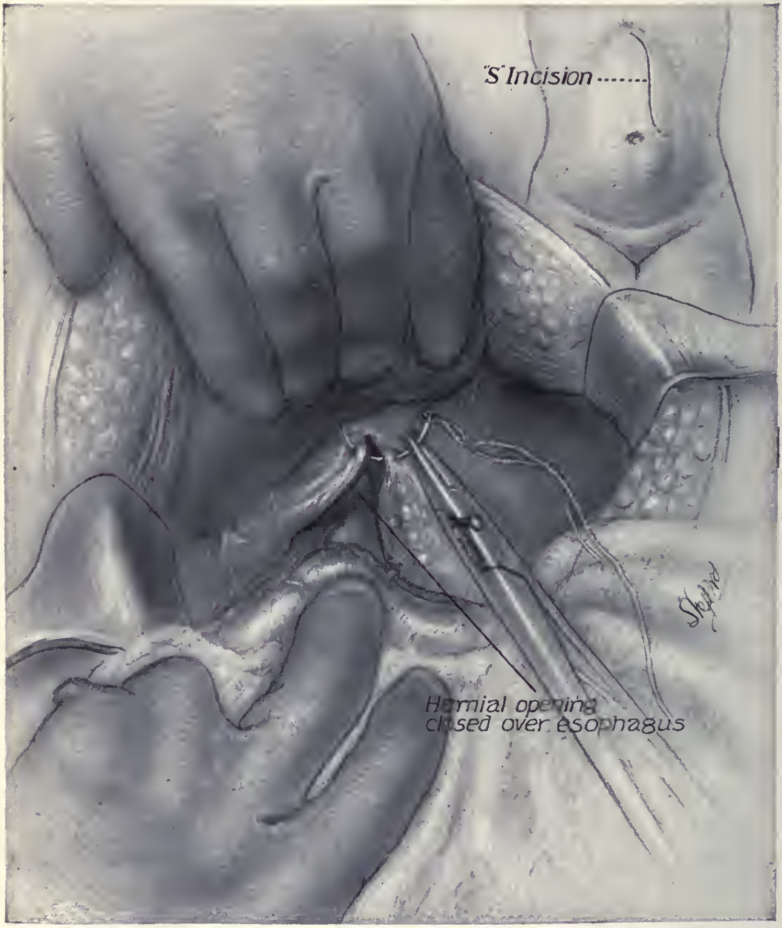

Fig. 190.—**S**-shaped incision and exposure gained thereby; closure of hernial opening by suture of the pillars of the diaphragm.

counted for, and my stenographer will make a note of that fact in the operative notes. The patient is in excellent condition at the close of the operation.

I want to use this case as a text to say a few words in regard to diaphragmatic hernias. We have had three of them in the last few weeks, one you have just seen operated upon, and two others that were diaphragmatic hernias of a part of the stomach through an enlarged esophageal opening have been presented on previous occasions. (See Surgical Clinics of Chicago, February and April, 1917.) I take it that no one has had enough experience with hernias of the diaphragm to warrant him in speaking dogmatically about the condition. I think, however, that the time has arrived when we should demand a somewhat better classification of these conditions than we have had heretofore, and to that end I suggest the following arrangement:

(1) True hernia of the diaphragm, such as the case which I have just operated upon. I would limit this class to the hernias that occur at the normally weak point in the diaphragmatic wall, namely, the esophageal opening. True diaphragmatic hernia, I think, occurs at this weak point, just as does an inguinal hernia at the weakened point in the abdominal wall through which the spermatic cord passes.

(2) In the second division I would place congenital diaphragmatic hernia in which there is a congenital defect in the diaphragm, and at birth a part of the abdominal contents are found in the thoracic cavity. Most of these cases are not consistent with life, although a few patients with such congenital defects in the diaphragm have been known to live to adult life or even to advanced age. Strictly speaking, I think that these cases should be classified as congenital defects of the diaphragm, or possibly as congenital diaphragmatic hernias, and not as true diaphragmatic hernias.

(3) Traumatisms of the diaphragm with such an injury as to permit the passage of part of the abdominal contents into the thoracic cavity. These, I think, should be properly classified as traumatisms of the diaphragm and are the results of stab wounds, bullet wounds, and of ruptures of the diaphragm from severe

contusions of the abdomen. Most patients, after these serious ruptures of the diaphragm leading to traumatic hernia, die as a result of the injury. Some of them, however, recover with resultant traumatic hernias, which may be operated upon shortly after the injury or later, or the condition may be such as to be compatible with life without any repair.

I think it important to make a sharp division between traumatisms of the diaphragm, with resultant hernia, and the true or the congenital hernias of the diaphragm. This is especially important because the line of attack, if surgical procedures are called for, differs so much in the two cases. In ruptures of the diaphragm the tears in most cases involve part of the periphery of the structure, permitting or sometimes demanding a transthoracic operation for their repair. In most congenital defects of the diaphragm with hernia and in true diaphragmatic hernia at the esophageal opening my experience teaches that the abdominal route is the one of choice.

It is hardly necessary for me to tell you how much the *x*-ray has done for us in increasing our ability to diagnose these obscure conditions. It has, in fact, given us an absolute means of diagnosis in many cases which would otherwise be very difficult.

I want to emphasize another point which has been gradually forced upon me from my increasing knowledge of these cases, and that is the desirability of attempting to analyze the etiologic factors in the production of each individual case. I am inclined to believe that in the ordinary true diaphragmatic hernia the same factors are responsible for the production of the condition that are responsible for the ordinary abdominal hernias, such as the inguinal and femoral. Let us see what these factors are. The presence of a weakened point in the abdominal wall and frequently of a preformed peritoneal sac passing through this opening, together with conditions that produce increased intra-abdominal pressure, such as straining, coughing and the incidence of pregnancy, seem to be the most important. In one of our cases which I have recently demonstrated the cause of the hernia was clearly a gradually increasing tension within the abdomen produced by a small circular carcinoma at the splenic flexure.

(See Surgical Clinics of Chicago, April, 1917.) This had led to such increased intra-abdominal tension as to produce a true hernia of the diaphragm and had forced part of the stomach into the thoracic cavity. The symptoms that are produced by this condition are not, as a rule, very clearly cut, nor do they point strongly to the existence of such a lesion. They are, as a rule, suggestive rather of some obstructive process in the stomach or intestines, and the condition becomes clear only after its discovery by x-ray examination.

Postscript.—The patient made an unusually satisfactory recovery, and left the hospital entirely cured of her diaphragmatic hernia and of the symptoms of which she had previously complained.

CARCINOMA OF THE JEJUNUM; 5 CASES OF CHRONIC INTESTINAL OBSTRUCTION DUE TO LESIONS LOCATED NEAR THE DUODENOJEJUNAL JUNCTION

Summary: Diagnosis of obstruction near the duodenojejunal junction; differentiation from obstruction at the pylorus—importance of the *x*-ray; causes of obstruction in this region; treatment. Management following gastro-enterostomy in a case with complete obstruction of the duodenum.

The last case which I shall show you this morning is a particularly interesting one that has been referred from the Sippy service to my surgical department. The clinical picture, briefly, is as follows:

A man of about sixty, who had been in very good health previously, has had during the last six months three severe acute abdominal attacks, associated with pain in the epigastrium and the vomiting of a large amount of fluid, sometimes a gallon or more, and with a general picture suggestive of an obstruction of the pylorus. These attacks, however, have been of short duration, and between the attacks the patient has been in fairly good health, although his weight and strength have been gradually decreasing. Dr. Sippy has had him under observation for some time, and after an exhaustive study has made a clinical diagnosis of an obstruction at some point high up in the small intestine. At first the findings seemed to point to an obstruction at the pylorus, but examination by means of barium meals, *x*-ray, and screen showed a normal stomach, no obstruction at the pylorus, a normal filling, and a normal duodenal cap. In several of a series of most careful screen examinations of the patient it was thought that a small lake of the barium would remain for a few minutes in the upper part of the small intestine shortly after it had passed through the duodenum. This was observed several times. This, with the fact that such large amounts of material were vomited when the patient had his attacks, suggested a probable diagnosis of an obstruction high up in the small intestine, possibly at the junction of the duodenum and jejunum or in the first part of the jejunum. On the basis of the above findings and the absence of a history of previous abdominal inflammatory lesions the pathologic process is regarded as probably carcinoma. With that clinical diagnosis, therefore, we shall make an exploratory operation, as you see, under ether anesthesia.

TECHNIC OF OPERATION

A midline incision is made extending from the ensiform to the umbilicus. On opening the peritoneum nothing abnormal is found at first. The stomach is normal and the pylorus and duodenum are normal. Examination of the colon is negative. On lifting up the great omentum and transverse colon and hunting for the first part of the jejunum, you see that I pull into view a very greatly distended loop of the jejunum, extending from the junction of the duodenum and jejunum to a point where I find, as I draw this loop of bowel into view, a zone of obstruction and a lesion (Fig. 191, *a*). This is evidently a carcinoma. It is about as large as a silver half-dollar and is located on the jejunum, about 12 inches from the duodenojejunal junction. You see that below this point the intestines are of normal size. On examining the mesenteric glands I find no glandular involvement, and on examining the liver no secondary masses of carcinoma in that organ. I shall, therefore, resect this definite gross lesion and make a lateral anastomosis.

I place two clamps on the small intestine about 3 inches on either side of the carcinoma, and remove this portion of the bowel with the tissues of the mesentery. The vessels in the mesentery are ligated. The ends of the small intestine are invaginated and closed with two purse-string sutures. Then, as you see, I make a lateral anastomosis as one would make a gastro-enterostomy (Fig. 191, *b*). I am using here the old Billroth method of three rows of sutures—one for the mucosa, one for the muscularis and peritoneum, and finally a Lembert. The pads and sponges are accounted for and the external wound is closed without drainage. The patient is in excellent condition at the close of the operation.

On examining the specimen there is shown on the peritoneal surface the characteristic picture of a carcinoma (Fig. 192, *a*). On opening the bowel the carcinoma is found to be larger on the inner surface than on the outer (Fig. 192, *b*).

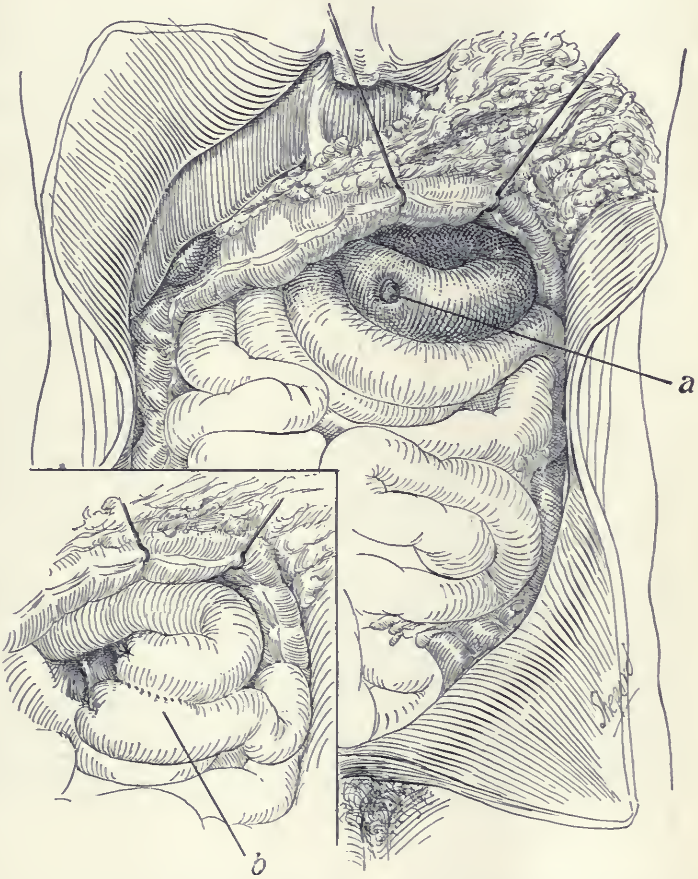

Fig. 191.—*a*, Location of carcinoma; note distended jejunal loop proximal to the lesion; *b*, resection of tumor and lateral anastomosis completed.

Postscript.—The patient made an uneventful recovery from the operation. His pre-operative symptoms disappeared entirely, and from the absence of any glandular or visceral involvement and from the limited extent of the lesion we believe that he has an excellent prospect of a permanent cure.

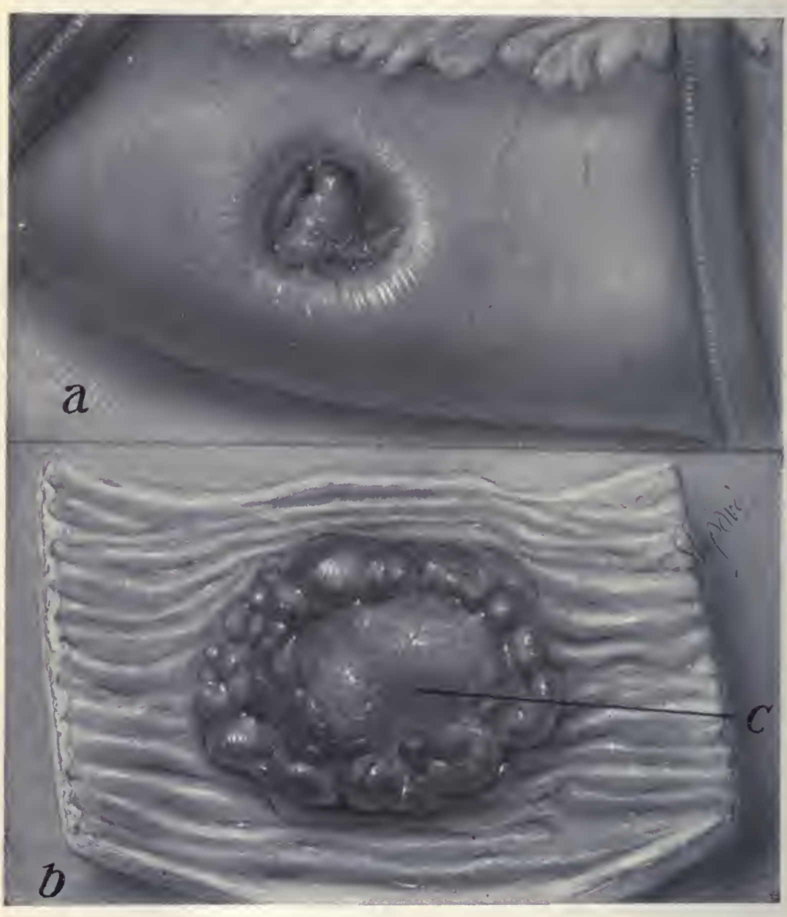

Fig. 192.—*a*, Carcinoma of jejunum from peritoneal side. Clamps are in position preparatory to resection; *b*, same lesion after resection; bowel has been opened, exposing the typical picture of an ulcerating carcinoma. (Both drawings have been made to the same scale.)

I wish to use this case as a text for the discussion of 5 cases of obstruction high up in the small intestine which we have had under our care during the past year. I think it is rather unusual to have the opportunity of observing a group of 5 of these cases within a short period. They are rare. They have interested us sufficiently to make us devote a good deal of careful study to this particular type of case.

The first case was a woman with an abdominal tumor which was of uncertain variety, until we had the opportunity of making a microscopic examination, when it proved to be a malignant epithelioma of the ovary. The patient came to the hospital with continuous vomiting, which at first was thought to be the vomiting of pregnancy, and the pelvic tumor was thought to be consistent with pregnancy. It was impossible, however, to control the vomiting, and later it was found that she was not pregnant, and the tumor was removed. When this was done we felt it would cure her condition, but the vomiting persisted after the removal of the tumor.

A careful study of the case seemed to show that she had an obstruction at the pylorus or high up in the small intestine. At the time that the tumor was removed the stomach and pylorus had been examined and no obstruction found. It was therefore thought because of her symptoms that she must have an obstruction high up in the small intestine. Another operation was done, and in drawing the omentum and transverse colon out of the wound an obstruction was found in the jejunum very close to the junction of the duodenum and jejunum, an almost complete and very narrow obstruction, not much larger in size than a bass viol string. A lateral anastomosis was made and the patient went on to a most satisfactory recovery, with an increase in weight of 30 or 40 pounds, and seemed to be perfectly well.

A year and a half or two years later, however, she commenced to have obstructive symptoms. Another exploratory was made and a wide-spread peritoneal involvement from the malignant epithelioma of the ovary was found, and the case within a short time went on to a fatal termination.

Another case which we still have under observation was one in which a diagnosis of pyloric obstruction was first considered, but, after careful analysis, it appeared that the obstruction was not at the pylorus, but high up in the small intestine. This clinical diagnosis was made before the exploratory. At the exploratory an obstruction was found at the junction of the duodenum and jejunum, and was so situated that no part of the duodenum covered by peritoneum could be brought down so as to make a lateral anastomosis and side-track the obstruction. On that account I made a posterior gastro-enterostomy, with the purpose of attempting to make the duodenum practically functionate as a part of the stomach, so that both stomach and duodenum would empty themselves through the posterior gastro-enterostomy opening. We have succeeded in doing this after a great deal of effort by washing the patient's stomach out repeatedly after the operation, and gradually the duodenum has assumed the function of part of the stomach, and evidently all the bile and pancreatic juice passes through the pylorus into the stomach and out through the gastro-enterostomy. The patient has gained 20 or 30 pounds in weight and is quite comfortable as long as he washes out his stomach once a day.

The character of the obstruction in this case we are unable to state. It may be benign. It may be malignant. If benign, it is the result of some old peritonitic process; if malignant, it may possibly be secondary to some primary focus elsewhere which we have not discovered, or possibly an exceedingly narrow circular carcinoma of the lowest part of the duodenum.

We have had two other very similar cases, one from adhesions following an exploratory laparotomy, and one from a carcinoma high up in the jejunum, both of which went on to operative recovery, but the case due to the carcinoma was followed later by a general carcinomatosis, and the case due to adhesions was followed by extensive general adhesions, which led to an obstruction of a number of loops of the small intestine, and finally terminated fatally in spite of repeated operations for relief.

I want to call your attention to this group of cases because of the fact that they are not, as a rule, diagnosed, and because, when a careful analysis is made, a proper clinical diagnosis can be made before the exploratory operation. In the main, the picture is that which suggests an obstruction at the pylorus, although the amount of material vomited is greater than would be probable with a pyloric obstruction. The *x*-ray evidence is of considerable value in showing a normal stomach and duodenum as far as the *x*-ray examination is concerned, and sometimes, as in the case which we have just operated upon, may be of value in showing a very short retention of a part of the barium meal high up in the small intestine, or there may be prolonged retention. I would emphasize, too, in discussing this group of cases the importance of studying them jointly with the internist and the roentgenologist, because it is in this way that we have been able to unravel several of these difficult problems.

CLINIC OF DR. ALBERT J. OCHSNER

Augustana Hospital

VAGINAL HYSTERECTOMY FOR CARCINOMA OF THE CERVIX UTERI: RADIO-THERAPY IN THE AFTER-TREATMENT AS APPLIED BY DR. HENRY SCHMITZ

Summary: A patient with the characteristic signs and symptoms of moderately advanced carcinoma of the cervix; vaginal hysterectomy; superior results obtained by the use of the cautery instead of the knife; threefold value of the cautery—(*a*) a cutting agent; (*b*) a hemostatic agent; (*c*) a destroyer of tumor cells; technic of the application and the results of radium and *x*-ray treatment in the after-care of cases of the above type.

History.—The patient, a married woman of thirty-four years, was admitted to the hospital March 27, 1917.

Her family history is negative as to carcinoma. One brother died of tuberculosis. She has had the usual diseases of childhood; typhoid fever seven years ago. Her habits are good. Menstruation began at sixteen years, regular, three days' duration, and a moderate amount. She has been married fifteen years and has three children.

In July, 1916, she had an abnormal uterine hemorrhage. In November she had a second, and two weeks ago she had a third which was more severe than the two previous ones. For the past month there has been a slight vaginal discharge with a bad odor. She has no other symptoms.

Examination.—The patient is an obese female with a good color. Eyes and nose are negative. Tongue is thickly coated and tonsils are small. The thyroid gland is easily palpable. The lungs are negative. The left border of the heart is apparently 1 cm. to the left of its normal location. There are no murmurs. The aortic second sound is sharp and snappy. The abdominal walls are thick, and at present there are no points of tenderness. Knee-jerks are lively. The cervix is enlarged to the diameter of 8 cm. It is nodular, hard, and irregular. The os is small. The body is also enlarged, somewhat movable; manipulation of it causes pelvic distress. Nothing can be felt in the fornices.

Operation.—Dr. Ochsner (March 28, 1917): You see this cauliflower-like mass protruding from the cervix. The mass represents a carcinoma and seems to have originated on the inside of the cervix. It is continuous with the mucous membrane of the cervix. It bleeds quite severely upon the slightest touch. With this electric cautery we cut away the margin of the vaginal mucous membrane 2 cm. wide of the growth (Fig. 193).

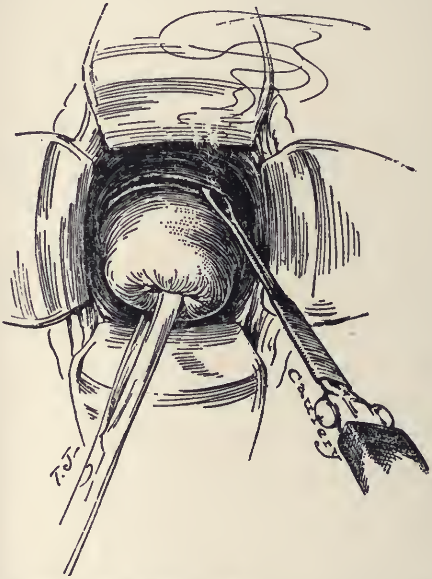

Fig. 193.—Vaginal hysterectomy with the electric cautery. Broad vaginal retractors applied. The vaginal wall severed with the cautery.

Thirty years ago Dr. O'Byrne, of Brooklyn, pointed out the advantage of removing these carcinomas with the cautery. We followed his advice at that time, and had some very remarkable results in cases that seemed hopelessly far advanced. Later on the plan of removing the carcinoma with the knife became popular. Then we too removed them with the knife, but soon found that our results were very much less permanent than they had been when we did our operations with the cautery, so we returned to the use of the cautery about twenty years ago, and we have been very well pleased with the results.

One feature that I dislike about this case is the fact that there seems to be a bacterial infection in addition to the carcinomatous infection, because we find a discharge of pus from the substance of the tumor. You see I am severing the vaginal attachments very carefully. Wherever I cut a vessel with the cautery I grasp it immediately with hemostatic forceps and leave these hemostatic forceps in place. We cut all our tissues with the cautery, so that at no point have we a raw surface that has not been seared. I cauterize with the actual cautery to control hemorrhage and also use the cautery as I would a knife to excise the growth.

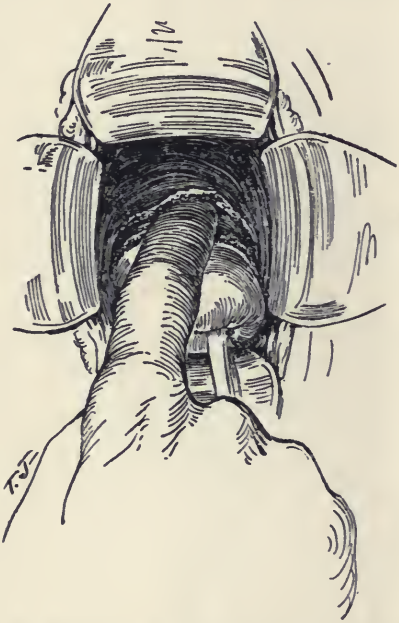

Fig. 194.—Showing the dissection of the uterus from the vaginal wall by means of the index-finger.

Now that the vaginal wall has been severed, I shall dissect it off of the uterus with the index-finger of the right hand (Fig. 194). This frees the uterus from the vagina so that the uterus can be brought forward by means of a claw-like retractor placed in the fundus. The broad ligament containing the uterine artery is next caught with forceps (Fig. 195) and severed with the cautery. Now I clamp the upper portion of the broad ligament and sever it in the same manner (Fig. 196).

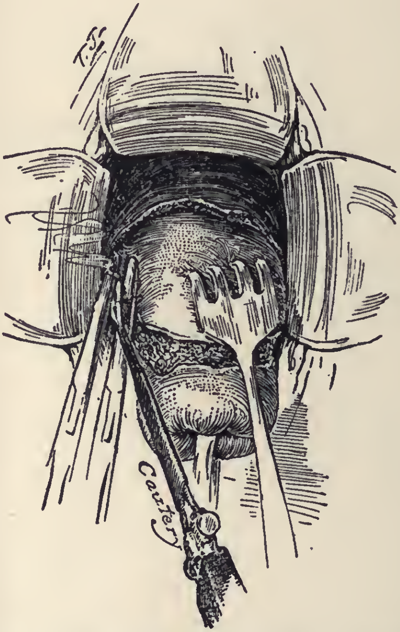

Fig. 195.—The fundus brought forward with a sharp retractor and the uterine artery being clamped and sectioned.

You see I have proceeded methodically step by step, taking care that there should be no point at which the uterus was severed from its attachments except by means of the cautery.

Now we have removed the entire uterus (Fig. 197). The blood-vessels appearing in the field have been kept under such complete control by our clamps and cautery that at no time has there been any considerable loss of blood. Our next step will consist in touching all the various pedicles, that are still in the grasp of the forceps, with the cautery, so that they will all be thoroughly seared over, and so that the heat will go from the actual cautery into the forceps and will destroy any malignant tissues which might possibly have been grasped by them.

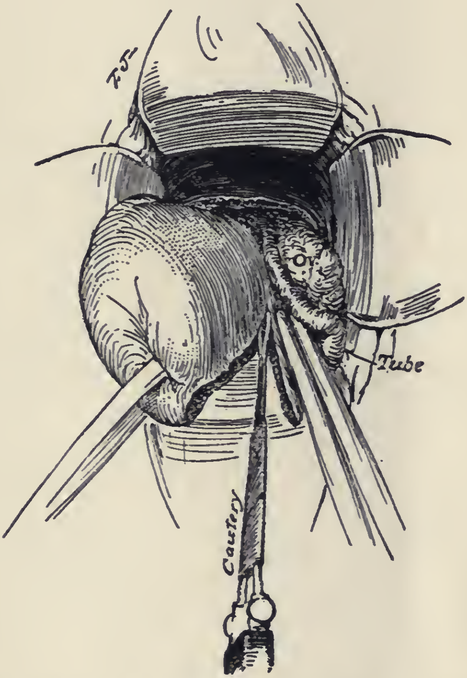

Fig. 196.—The remainder of the broad ligament clamped and sectioned, thus freeing the uterus.

In my own experience the only cases that have recovered permanently are the cases in which we inserted soldering-irons heated to a white heat directly into the cavity of the uterus, in that way destroying all the tissues and leaving a shell of the uterus in place. For a time we were under the impression that it would be possible for us to dissect out the lymph-nodes along the iliac artery and vein, and in that way prevent a recurrence of the carcinoma in the cases that had advanced too far to be relieved by the operation that I am doing now, but so far our results have not justified the additional risk to which this maneuver has exposed the patients. The immediate mortality was much higher then among similar patients not so treated, and the ultimate mortality was fully as high, so that at the present time we do three operations: First, the operation I have just performed, consisting of the removal of the uterus by clamping all its attachments, cutting them with the cautery, and cauterizing the stumps. The second operation consists of cutting off the vaginal attachments of the uterus by means of the cautery, and then doing an abdominal hysterectomy, removing at the same time both ovaries and

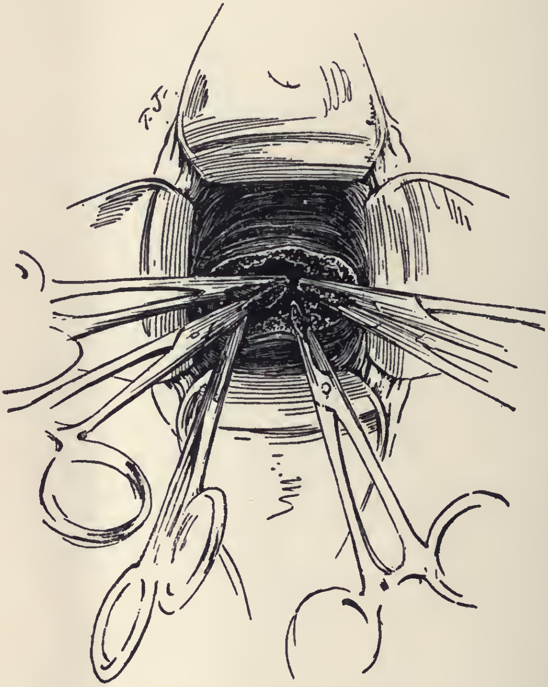

Fig. 197.—The uterus removed.

tubes. The third method, which we use only in the hopeless cases, consists in first cureting out the carcinoma very rapidly, and then cauterizing all the tissues by inserting the cautery irons into the cavity of the uterus and simply cooking the uterus until it is completely destroyed.

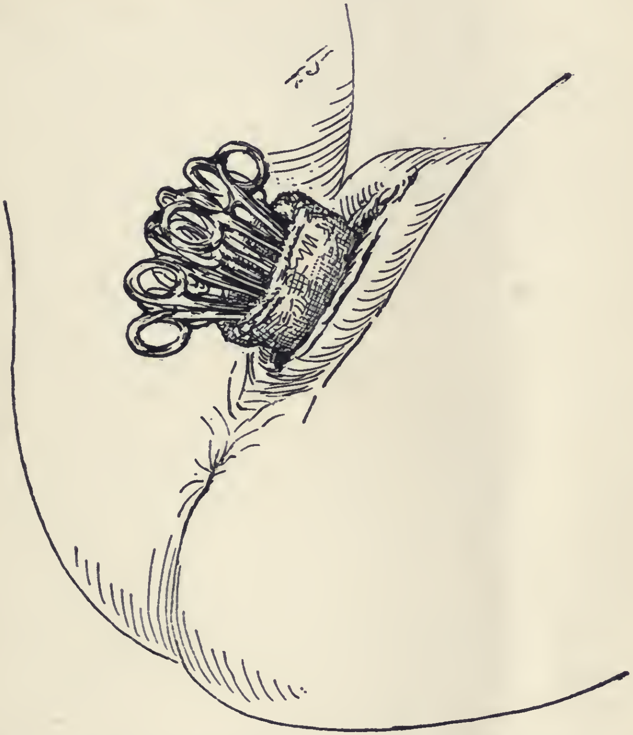

Fig. 198.—Showing the forceps and gauze pack left in place. A retention catheter from the bladder should also be shown.

In the case before us I leave all these forceps in place so that there can be no chance of bleeding. Around the forceps I pack a strip of iodoform gauze so as to prevent pressure-necrosis of surrounding tissues (Fig. 198). The forceps will be loosened after thirty-six hours, left in place for twelve hours more, and then withdrawn. We will give the patient intensive *x*-ray treatment over the pelvis and also radium treatment in the wound crater. Dr. Henry Schmitz will tell you how he will apply the radium in this case.

Dr. Henry Schmitz: Recurrences of uterine tumors after surgical eradication of the diseased organ occur in three ways: (1) In the tissues surrounding the organ, as the vagina, the bladder, the rectum, and the parametria; (2) in the regional lymph-gland groups, especially the hypogastric, iliac, and sacral in cervix carcinoma and the inguinal and lumbar in corpus cancer; (3) in distant organs. The object of radium and roentgen-ray therapy is to prevent recurrences in the pelvic tissues and organs, the regional lymph-glands, and also in the secondarily invaded distant organs, if they are amenable to the treatment.

We may state that the indications for the employment of each of these irradiations are definitely fixed. Radium rays act best if brought in close or immediate contact with the organs or tissues to be treated. Therefore, skin cancers and growths that can be reached through natural or artificial canals may be treated with radium rays. The roentgen rays may be applied to almost any part of the body and to large areas which could not be reached or could not be so effectively influenced with radium rays.

Hence, radium is inserted in the crater of the broad ligament to destroy, if possible, all carcinoma tissue and cell-nests that were not removed by the knife and the cautery, while the roentgen rays are applied through the abdominal wall anteriorly, and the sacral region posteriorly, to destroy the carcinoma deposits in the lymphatic vessels and glands and their contiguous tissues.

When radium is used after a hysterectomy as a prophylactic we insert a capsule containing 100 mg. radium element for about ten hours. The alpha- and beta-rays are arrested by a brass screen of 1.2 mm. thickness. The secondary, or Sagnac rays, which form in the metal filter, are absorbed by a pure para-rubber tubing of about 3 mm. thickness. The application is made as soon as the patient has recovered from the effects of the operation and the packing has been removed, *i. e.*, three to five days after the operation, and is repeated ten days later. The total amount of milligram hours, therefore, is about 2000.

The technic of the roentgen-ray treatment is as follows: The suprapubic region is divided into eight to twelve squares and the sacral region into four to six squares of 1½ inches each. A Coolidge tube of a hardness of ten Heinz Bauer is loaded with 8 milliamperes of current. The focal distance, that is, the distance from the anode to the skin surface, should be 21 cm. The tube is tilted so the rays are directed into the pelvis. The rays are filtered through a sheet of aluminum 4 mm. thick. The secondary rays are rendered inert by distance filtering, the aluminum screen being inserted at about half-way between the anode and the skin surface. An erythema dose, *i. e.*, 1 E., will thus be reached within three to four minutes' exposure. About 2.5 E. are given to each square. If twelve fields or portals of entrance are employed a total amount of about 30 E. or 300 X is given. The entire amount is applied within one to three days. Such a course of roentgen-ray treatment is repeated after three weeks. During the time of the treatment and for an additional week 2 grams of sodium bicarbonate are given to the patient internally daily.

The patient is requested to return for examination every six weeks. A careful inspection and bimanual vaginal and rectal palpation are made. If a recurrence is detected, another course of radium and roentgen-ray treatment is immediately ordered.

Some patients do not exhibit any accessory symptoms or side actions, while others will show various degrees of one or more or all the following symptoms: nausea, vomiting, anorexia, rectal irritation, diarrhea, vesical tenesmus, frequent urination, and lassitude. These symptoms are the result of toxemia, the toxin being produced by the cell death caused by the actions of the rays. They are usually transitory, but may become very persistent, baffling all attempts at relief. Should the latter take place, the patient may, indeed, lose in strength and weight and become desperately ill. This is, fortunately, the exception.

We cannot render an opinion of the value of prophylactic actinotherapy. Some patients succumb to recurrence in spite of its use, while others have survived periods of years free from any recurrence. If we consider the experience of other clinics, we must conclude that all operations for carcinoma should be followed by the combined radium and roentgen-ray treatment. Statistics of Kelly and Burnam, Kroenig and Gauss, and our own seem to coincide with this opinion.

CLINIC OF DR. ALBERT E. HALSTEAD

ST. LUKE'S HOSPITAL

INTERNAL HYDROCEPHALUS: PUNCTURE OF THE CORPUS CALLOSUM

Summary: A child, twelve years old, with hydrocephalus of three years' duration; the history and physical examination; pathology of internal hydrocephalus; treatment—technic of puncture of the corpus callosum.

G. S., FEMALE, aged twelve. This child up to three years ago was in the best of health. About five years ago the parents thought her vision was affected. Examination of the eyes at that time by a competent oculist showed no abnormality. Vision was normal after correction for a slight astigmatism. Three years ago the parents discovered that she could not see with the left eye. About this time they detected a slight enlargement of the head. The child at that time complained of dizziness and progressive loss of vision. Eleven months ago she became ill with a febrile attack. The third day of the attack she had two general convulsions, preceded by severe headache, vomiting, and dizziness. The convulsions lasted for several minutes and were followed by a mild delirium that lasted for about three hours. Following the delirium she became drowsy, and passed into a deep sleep that lasted for eight hours. Since having the convulsions her general health has greatly deteriorated and her appetite is poor. She complains of pain in the head, particularly in the mornings, and of a severe ringing in the ears and dizziness, which pass away as the day advances. She is now completely blind in the left eye. She can distinguish persons and objects with the right eye and read large print. Her mental condition is good. She has the appearance of being unusually bright and cheerful. She had measles during her fifth year; no other diseases of childhood. The family history is negative. The Wassermann is negative.

Physical Examination.—The patient is a little girl about twelve years of age, fairly well developed, but small for her age. She appears mentally normal. Head, neck, and scalp are negative for scars and defects. The head is covered with an abundance of hair. The pupils react to accommodation. She can see nothing with the left eye. With the right eye she can distinguish objects and read newspaper headlines. She has control of all the muscles of the eyeball in divergence and convergence. No nystagmus. The ears are perfectly normal. She can distinguish the tick of a watch at a distance of about 4 feet. There is no difference in the two ears. There is no facial paralysis. The two sides appear equally strong. Taste is normal on both sides of the tongue. She can distinguish bitter and sweet equally well on all parts of the tongue. There are no hyperesthetic or anesthetic areas. Reflexes present and normal. The chest is fairly well developed. The heart and lungs are negative to auscultation and percussion. The heart sounds are clear. There are no râles. The abdomen is negative. The liver and spleen are not palpable. There are no tender areas or masses. The extremities are negative. Apparently there are no lesions of the cranial nerves except the optic nerve.

COMMENTS

Free communication between the ventricular contents and the subdural space is necessary if the nutrition of the brain through its normal blood-supply is to remain undisturbed. Any interference to the free interchange of fluid between the ventricles and the subdural space is followed by an increase in the intraventricular pressure, which, in turn, compromises the blood-supply to the brain, bringing on various disturbances of function. When, from whatever cause, the obstruction to the escape of ventricular fluid into the subdural space occurs, distention of the ventricles results. This we recognize as internal hydrocephalus. Disturbance in the free circulation of the ventricular fluid may be due to a primary closure of the normal channels leading from the ventricles; or it may primarily result from some obstruction of the veins of the ventricular walls, arising as a sequence of the ventricular distention. The closure of the normal ventricular canal may be brought about by a variety of lesions. Generally speaking, it is the result of an inflammatory process or it may be due to the pressure of a tumor. In a like manner the pressure from a new growth may obstruct the veins conveying the supply from the ventricular areas, causing an increase in the fluid content of the ventricles and resulting in distention of the ventricles, which, in turn, by pressure causes closure of the ventricular outlet.

In order to re-establish a free communication between the ventricles and the subdural space a permanent opening must be established with the least possible damage to the interposing portion of the cerebrum. To meet this requirement Anton was the first to propose a puncture of the corpus callosum (Balkenstech). This procedure, though not devoid of danger, possesses a minimum operation risk and offers a fair outlook for permanent relief when the obstruction is not due to new growth. In the latter case it probably does as much in the way of temporary relief from the increased intracranial pressure as the various decompression operations that are in vogue. It has been employed by the European surgeons in epilepsy, hydrocephalus, brain tumors, including tumors of the hypophysis, in meningitis luetica, and in tower skull. Anton reports 53 cases operated upon for these various conditions. The results were best in internal hydrocephalus of early life. Of these, he reports 17 cases with optic atrophy and without choked disk. In 2 with choked disk improvement in vision was obtained. In choked disk in brain tumor rapid improvement in vision was the rule.

In the patient we show you the eye-grounds show an optic atrophy in both eyes. There is no choked disk. In the left the vision is completely destroyed; in the right eye vision is 6/200. We propose to establish an opening through the corpus callosum and permit a free communication between the lateral ventricles and the subdural space, so as to diminish the intraventricular pressure. This will relieve headaches, and may pos-

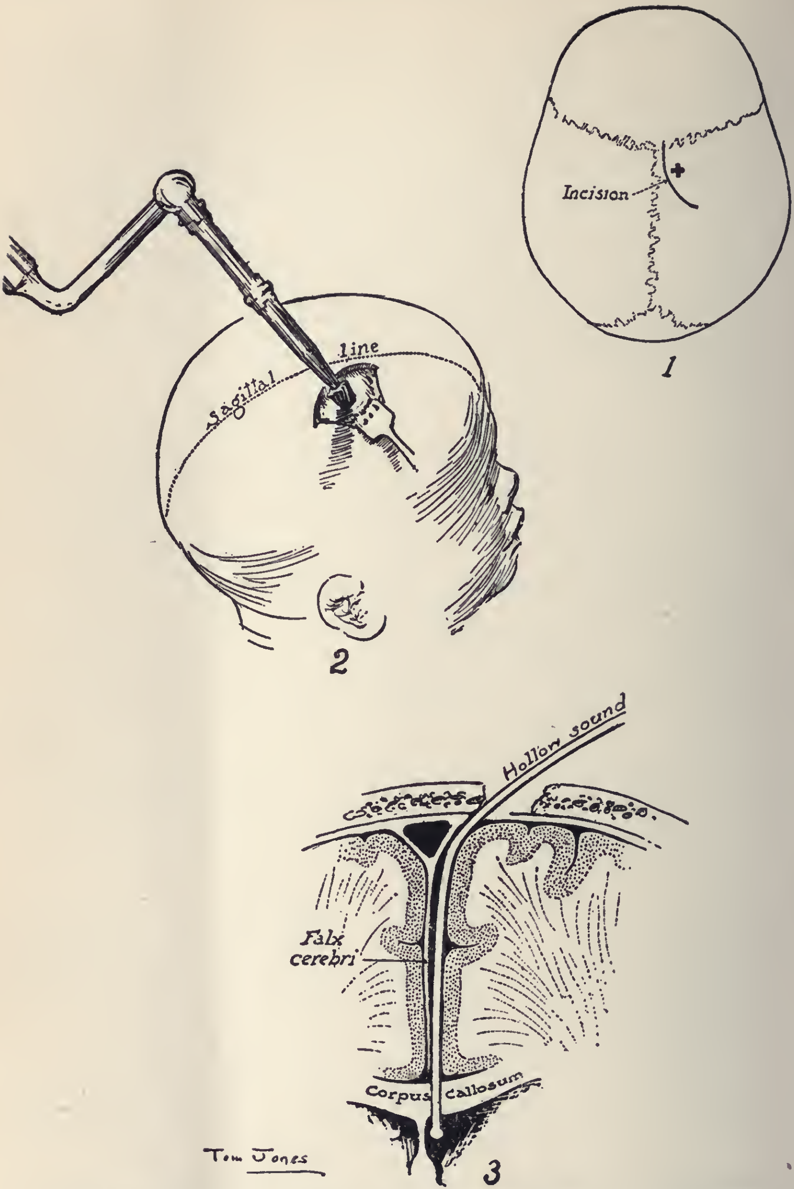

Fig. 199.—Technic of puncture of the corpus callosum. 1. Scalp incision: + indicates the point for trephining and is 1.5 cm. distant from each, the parietal and the coronal sutures. 2. Incision completed. Trephine opening being made. 3. Diagrammatic section showing the direction taken by the hollow sound and the depth to which it is introduced.

sibly prevent convulsive attacks and save what vision remains. The question as to what improvement, if any, will take place in the atrophied nerve is problematic. There is not much hope offered to the patient of any improvement in vision.

TECHNIC

The incision is made through the soft tissues to the bone, about 3 cm. long and parallel with the interparietal suture and 1½ cm. to the right of the median line (Fig. 199). With a Hudson drill an opening is made in the skull 1½ cm. behind the coronal suture and 1¼ cm. from the median line. This opening may be enlarged backward with a Macewen forceps. An incision is made in the dura 1 cm. in length. A flexible hollow needle with a stilet and having a blunt end is introduced under the dura toward the median line until the falx cerebri is reached. It is then turned downward, passing along the falx until it comes in contact with the corpus callosum, forming the roof of the lateral ventricle. This is reached at a distance of 4 or 5 cm. The corpus callosum is then punctured, the needle passing into the lateral ventricle. The stilet is withdrawn, and from 4 to 10 c.c. of cerebrospinal fluid is permitted to escape. If the needle has sufficient resistance the opening in the corpus callosum is enlarged so as to make it permanent by moving the needle laterally. In this way the substance of the corpus callosum is torn. By this operation the intraventricular pressure is reduced and a larger surface, that of of the subdural space, is offered for absorption of the excess cerebrospinal fluid.

PYLORIC OBSTRUCTION FOLLOWING SULPHURIC ACID POISONING

Summary: Signs and symptoms of sulphuric acid poisoning as shown by the present case; symptoms of pyloric stenosis developing during the third week; the roentgen-ray diagnosis; operative findings; anterior retrocolic gastro-enterostomy.

E. W., age seventeen, entered the hospital about five weeks ago, immediately following the ingestion of sulphuric acid taken with suicidal intent. The quantity swallowed is not known. On admission he showed evidences of sulphuric acid burns on the lips and chin. He was conscious and in great pain, restless, and had frequent attacks of emesis. The fluid vomited was bloody and of a dark-brown color, with a strongly acid reaction and a sour odor. The pulse on admission was 100 and his temperature subnormal. In a few hours the pulse became weak and thready. Prostration was pronounced.

The usual antidotes were administered with stimulants and his condition gradually improved. The vomiting became less frequent. The bloody vomitus gave place to a mucopurulent fluid. At the end of four days the patient began taking liquid nourishment. He was able to return to his home on the ninth day.

About ten days after he left the hospital he had an attack of emesis, in which he vomited a large quantity of bright red blood. This was repeated the following day. Two days later he vomited again. This time the vomitus was made up of pure pus, the quantity amounting to about 4 ounces. Since then the vomiting—that is, emesis with blood—has been a daily occurrence. Food taken into the stomach is vomited within a short time. The vomitus contains all the food taken, mixed with blood and pus, and has a sour, fetid odor.

It has been apparent for the last three weeks that nothing has passed through the stomach. He has been sustained with nutrient enemata made up of 5 per cent. solution of glucose.

Repeated examinations with the *x*-ray, both fluoroscopic and by radiogram, after barium meals confirm the opinion that there is a complete obstruction to the outlet of the stomach. The radiogram I show you would lead us to expect that the obstruction to the stomach occurs about the middle of the organ and that no barium passes beyond the constricting ring. The picture would suggest an hour-glass stomach, with two cavities completely separated by a constricting ring. The entire remaining functionating part of the stomach is represented by a small cup-shaped cavity immediately below the cardia. This cavity will hold about 4 ounces of the barium mixture (Fig. 200).

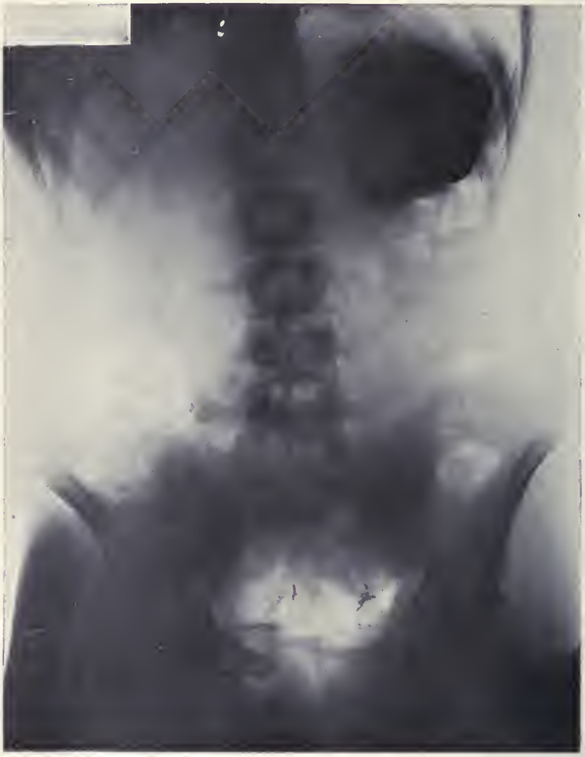

Fig. 200.—Roentgenogram showing remnant of functionating stomach. Complete obstruction distally.

The indication present in this case is plain; that is, to furnish an outlet to the remaining portion of the stomach. This can probably be done by a gastro-enterostomy, provided that the portion of the stomach wall forming the cup-shaped cavity has not been eroded by the acid to a degree preventing us from making a satisfactory anastomosis.

OPERATION

The usual median incision is made from the ensiform to the umbilicus. On opening the abdomen, before disturbing the relations of the organs, we see what appears to be a greatly constricted and deformed stomach (Fig. 201). There is a deep constriction extending from the lesser to the greater curvature, involving both the posterior and the anterior walls. The constriction is high up on the stomach, the part below representing about two-thirds of the entire organ. The latter, or pyloric portion, instead of being a closed cavity is a mass of firm tissue without any cavity being in evidence. What has happened is that the mucous membrane of this portion of the stomach has been destroyed and the cavity obliterated to a point just above the pyloric ring. Upon raising the transverse colon and endeavoring to reach the posterior wall through an opening in the transverse mesocolon,

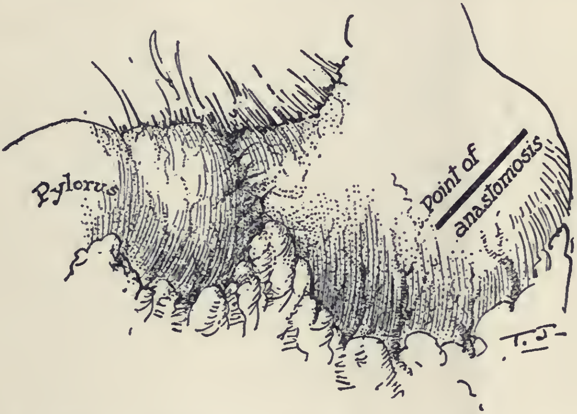

Fig. 201.—Appearance of stomach at operation. Note the deformity of the distal half.

we find that the lesser peritoneal cavity has been obliterated by the inflammatory process, the result of the corrosive action of the acid. There presents no surface posteriorly upon which the intestine may be fastened. We are, therefore, forced to bring the jejunum forward and attach it to the anterior wall of the stomach or to that portion remaining, which is, in reality, the fundus of the organ. In order that the most direct attachment of the jejunum to the fundus may be made, we tear through the transverse mesocolon close to its attachment to the transverse colon, and pass a loop of the jejunum through this opening, and then we make an anastomosis between the anterior wall of the stomach and the jejunal loop. This operation is the usual *anterior retrocolic gastro-enterostomy*. We use the Moynihan clamps and follow his technic and suture, using fine Pagenstecher's linen for the serous suture and fine chromocized catgut for the through-and-through suture, employing in the latter the well-known Connell method. Before completing the operation we suture the margin of the cut edge of the mesocolon to the stomach with a few interrupted sutures. The abdominal wound is closed, first, by continuous iodized catgut suture; second, by an interrupted fascia and muscle suture of chromicized catgut; third, by an interrupted skin suture of silkworm-gut.

CLINIC OF DR. L. L. McARTHUR

MICHAEL REESE HOSPITAL

THROMBO-ANGIITIS OBLITERANS OF BUERGER: MODIFIED KOGA TREATMENT

Summary: Theory and results of treatment by means of the intraduodenal injection of Locke's solution; clinical course of thrombo-angiitis obliterans; failure of medication; other methods of treatment; where and when to amputate—the Moskowicz test; trial of the modified Koga treatment should precede amputation.

WE see here, in a Jewish Hospital, a form of gangrene of the foot due to a condition that is not seen in our other hospitals to any such extent. I refer to the thrombo-angiitis obliterans of Buerger, which results in closure of the blood-vessels, generally of the lower extremity, although it may occur in the upper extremity, which, in turn, results in gangrene of the toes and foot and finally of the whole limb. On learning of your coming I thought, as I had 2 such cases in the house, that I might show you what we are now doing for them. I presented to the Chicago Surgical Society about a year ago 6 cases of this type of gangrene, some of them cured, some of them in the process of cure, and some of them improving.

CASE I.—The first case I will show you is that of a man who presents a typical example of incipient thrombo-angiitis obliterans of Buerger. His foot, after ten days' treatment (and you will have to take my word for this), has changed from a dark cyanotic and cold foot into a foot which is now perfectly warm, as warm as anybody's foot. Today you will see a little granulating area, the site of the gangrene which had started in the great toe before admission to the hospital. This patient is now able to be up and around. You see that he walks with a little limp; before he began treatment he was confined to bed with pain, that type of pain which morphin fails to relieve.

You recall that Koga, of the University of Tokio, made some investigations in regard to the treatment of this type of gangrene. In these investigations he showed that by diluting the blood he could reduce its viscosity. Now the rate of flow through the artery is dependent upon the viscosity of the blood. If you have a blood-vessel whose lumen is narrowed down to a point, the flow through it is practically nil. If we dilute the blood by one-half we double the rate of flow. To obtain this result Koga recommended hypodermic injections of normal salt solution; a hypodermoclysis with 1 liter of salt solution at each sitting. This was done in a number of cases, and resulted in slow and gradual improvement when there was just dry gangrene of the toes with a definite line of demarcation, but no suppuration and no discharge. After the treatment had been in use for weeks there would start up a mild suppuration with a pouring out of leukocytes. Finally, all that would be necessary would be to amputate the dead portion, following which the living portion would begin to cicatrize. Such a case I showed last year, and I happen to have these two now to show you, and I wish to point out the modifications which we have made in the method of introducing the fluid and in the composition of the fluid.

After using the hypodermoclysis method for a time I sought another method of administration, as repeated subcutaneous injections of such large quantities of solution are attended with a great deal of discomfort. I tried intravenous injections at the elbow. After repeated intravenous injections one of two things happened, either the vein became obliterated or the tissues became so sore locally that the patients were inclined to discontinue the treatment. Then my colleague, Dr. Davenport, suggested that we introduce the fluid into the duodenum through a Rehfuss tube. With a Rehfuss tube you can introduce into the duodenum an incredible amount of fluid without causing any discomfort to the patient. Instead of giving 1000 c.c. two or three times a week, we can give a gallon or a gallon and a half per diem, which, of course, dilutes the blood absolutely. It flushes out the kidneys and later makes watery bowel movements, but you can dilute the blood so thoroughly by this method that its viscosity is markedly reduced and the patient gets better. I have said that Koga used normal salt solution. We have felt that our results have been improved by the use of a physiologic solution, such as Locke's, a solution in which the calcium and potassium salts are present as well as the sodium, and so we now use it in our routine treatment.

Case II.—In 1914 the toes on this man's right foot became gangrenous and were, therefore, removed. Later a portion of the stump became gangrenous, and in an attempt to check the process a portion of the foot was removed, but in a few months gangrene appeared in the fresh stump. He then came into this hospital in the service of Dr. D. N. Eisendrath, who, realizing the fact that the disease is associated with narrowing of the tibial vessels fairly high up in the calf of the leg, made an amputation of the leg above the knee. After two years the patient returned to the hospital with gangrene of the toes of the left foot, which had gone on to complete destruction of the first phalanx of the first and second toes. The foot as a whole was cold, blue and cyanotic, and was the seat of a great deal of pain. We began our treatment three weeks ago, and today you see that the foot, instead of being blue and cyanotic and cold, has become warm. Here, under this treatment, a line of demarcation has formed on the gangrenous first and second toes and both surfaces are healing with no signs of gangrene remaining. I want you to note how this is cicatrizing. The foot looks swollen and red. This is due to the edema that appears when you crowd the fluids. Instead of amputating I simply removed the dead toes, and I feel very sure of saving the foot.

The disease is peculiar, in that it affects the Jewish race more than other races. Next in frequency it is found among the Japanese. Men are affected more commonly than women, in the proportion of 8 to 1. I quote Da Costa when I say that the disease usually, but not always, begins in the left leg. It may start almost simultaneously in both legs. If it begins in one leg, the other tends to become affected sooner or later.

It comes on with attacks of severe pain in the toes, foot, or leg, the extremity feels cold and looks bloodless, and no pulse can be detected in the dorsalis pedis and posterior tibial arteries. Such attacks are at first brought on by cold, later they appear to arise spontaneously.

When the foot is warmed some color returns and feeble pulse may be appreciated. Many of these patients get so that any attempt at walking causes violent pains in the calf muscles, pain so violent as to make the victim limp in torture or at once stop walking (*intermittent claudication*).

After a case has lasted a number of months *erythromelalgia* may develop. In this condition when the foot is hung down the toes and dorsum rather rapidly grow bright red.

After a case has lasted for many months it will be impossible at any time to detect a pulse in the dorsalis pedis or posterior tibial. The patient is worn out with violent pain and cannot walk. Whenever the foot hangs down it becomes red or cyanotic. A bleb or ulcer may form upon the foot or great toe; it is sure to be intensely painful, and finally dry gangrene occurs.

The characteristic combination is violent pain, with absent pulse in the dorsalis pedis and posterior tibial arteries.

Da Costa says that he has never seen the slighest lasting benefit from medication. Sooner or later these cases come to amputation. In some cases violent pain compels amputation even before gangrene begins. Gangrene imperatively calls for it. Not unusually, weeks or months after amputation of one leg, the other leg has to be sacrificed.

The amputation should always be above the knee in order to be well above the thrombi in the vessels. Surgeons have used Moskowicz's test to determine where to amputate. Moskowicz applies an elastic bandage from the toes to high up the thigh, puts in place the tourniquet band, and removes the bandage. In five or ten minutes he removes the band and notes the color of the limb as it is invaded by reactionary hyperemia. This wave of color travels toward the periphery. High up the extremity the reactionary blush appears quickly. The nearer the area of vascular obstruction, the slower the manifestation of color. In doubtful areas the blush comes slowly and imperfectly and patches of white show here and there. In a region of total ischemia no reactionary blush occurs. Operation must be performed in the region where there is a complete red reaction, and never through an area where anemic patches are noted. Since Carrel's studies on reversal of circulation surgeons have attempted to prevent this and other forms of gangrene by arteriovenous anastomosis.

Early in a case, when we may assume that the veins are free from clot, the operation is clearly justifiable and may perhaps prove successful. Bloodgood has had success in a case which seems to have been of this type.[1]

I feel that we are under moral obligations at least to try the treatment which I have outlined before amputating the affected extremities in these cases. Before giving the treatment it is important to rule out syphilis, because syphilitic endarteritis may cause a similar clinical picture and, of course, requires specific treatment. I can see no reason why it cannot be used in diabetes.

This man has been getting, during the last ten days or two weeks, 4 to 6 liters of the solution a day by means of the duodenal tube. We are using this method entirely, and find it both convenient, comfortable for the patient, and efficacious.

NOTE.—Since this clinic was given a case of diabetic gangrene involving the great and little toes of one foot has healed under the above treatment combined with regulation of the diet.

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[1] Bernheim, in Amer. Jour. Med. Sciences, February, 1912.

CLINIC OF DR. E. WYLLYS ANDREWS

Mercy Hospital

VARICOCELE: NEW, OLD, AND COMBINED METHODS OF OPERATIVE RELIEF

Summary: Hypertrophy of the scrotum and varicosities in the wall of the scrotum frequently a source of discomfort even though the varices in the cord have been removed; shortening of the scrotum by operation sometimes gives relief, but a combination of both methods avoids all the objections to each and saves much time; technic of the Ferguson operation; use of a double row of stitches permits effective prevention of postoperative hemorrhage.

The operation here shown is a shortening of the scrotum by using a double line of sutures. It is a modification of the ancient operation of Sir Astley Cooper and the various forms of clamp amputations of the scrotum, and has all the advantages and none of the drawbacks of these methods. On comparing notes with the late Dr. Ferguson I found that each of us had published the technic as original, but that his paper had antedated mine. It should, therefore, be called "Ferguson's operation," if it deserves a separate name.

In practice I usually combine vein resection with shortening of the whole scrotum. It is true that when careful vein resection is done the cord mass is reduced in size and length and the varices cured permanently. This lifts the testis when too dependent, but what disappoints some patients is that the redundant scrotal sac persists even while the testis is held up close to the pubis. One cause of this is the acquired hypertrophy of the scrotal skin and dartos, and occasionally the cause is seen to be the presence of varices in the scrotal tissues apart from the cord and testis. These, of course, may escape obliteration when the plexus on the cord and epididymis is resected.

When the scrotal skin remains hypertrophied in spite of curing the varix of the cord, there remains a disability for manual labor in some laboring men due to the weight and intertrigo of the redundant scrotum, especially in warm weather. If a suspensory still has to be worn, the patient thinks he is not cured, although pain and dragging from the testis itself has theoretically been relieved.

On the other hand, if the scrotal sac is so shortened as to be round instead of pendulous—of the canine rather than the capricorn type—the veins are so far supported that they empty themselves just as they do in the recumbent position, and the patient feels relieved quite as well or better than when only vein surgery has been attempted. This clinical observation I have made many times. It probably explains the popularity of the old Cooper method which could be done even before antiseptic times without much risk, whereas vein resection by the old methods caused quite numerous accidents involving, we are informed, occasional gangrene of the testicles. Sometimes I found that scrotal shortening alone did not empty the varix wholly, but that it would remain as a visible or palpable tumor in the upper scrotum and canal. While this is the exception rather than the rule, I find it expedient and satisfactory of late to combine both methods in the same case. I therefore begin by opening just below the external ring and, making as dry a dissection as possible, at once clear the cord mass and divide its elements into two bundles. One bundle, containing the vas deferens, artery, nerve, and a liberal cluster of veins, is drawn aside to be preserved. Anastomotic branches make the separation a little difficult, but usually the two bundles are drawn apart by blunt dissection only, the one to be destroyed, the other to be preserved.

The mass of veins marked for resection should be ligated carefully in two places 10 to 15 cm. apart and the intervening portions removed, after which the stumps are tied to each other, thus shortening the whole cord and suspending the testis.

Senn advocated suturing the vertical skin incision transversely in order to shorten the scrotum, but the effect thus obtained is hardly noticeable in bad cases. I therefore proceed at once to amputate the lower half or two-thirds of the scrotum, converting it into its own suspensory bag and incidentally destroying whatever loops and varices are scrotal rather than testicular. Sometimes these are an important factor and sometimes not observed at all. One is apt to remove too little of the scrotal sac. The operation will be disappointing even if a large piece—one-half or more of the scrotum—is amputated, if much loose sac is left above. The skin has a surprising tendency to stretch out again when enough apparently was taken away, and may be still too long within a few weeks of the operation. I therefore remove enough to make it slightly tense, holding the testes rather snugly up against the pubes, as shown well in the photographs of this case. Such a case, which looks uncomfortably tight and globular, will, in fact, be quite pendulous enough after healing. This is partly due to the relaxation of the upper stitch line and partly to an unexpected elasticity of this tissue. Unlike any other part of the skin, except possibly the palpebral integument which it resembles, it is soft, devoid of adipose, and of rubber-like elasticity (Fig. 202, 1, 2, and 3).

So apparently simple an operation as cutting off and sewing together this scrotal sac is tedious and full of embarrassment unless done with certain precautions. The scrotal walls have numerous arteries and veins. The testes when their support is removed roll out as if from a cavity, apparently naked, but, of course, really enmeshed in the dartos. Vessels retract out of sight and hemostasis is tedious, as is also the closure with stitches. If hematoma, infection, or both occur in the wound afterward, it is not to be wondered at.

All these troubles are apparently overcome by the clamp operation. The varicocele curved clamp is placed at the right level, holding the skin together and the testes well supported while the segment below is cut off and the stitches inserted. Unfortunately, this instrument has defects. While holding the scrotum in position, it also may compress the blood-vessels. Their cut ends may not be seen and tied. When the suturing is complete and the blades of the clamp are opened, bleeding may go on at the time or later internally into the scrotal stump, forming

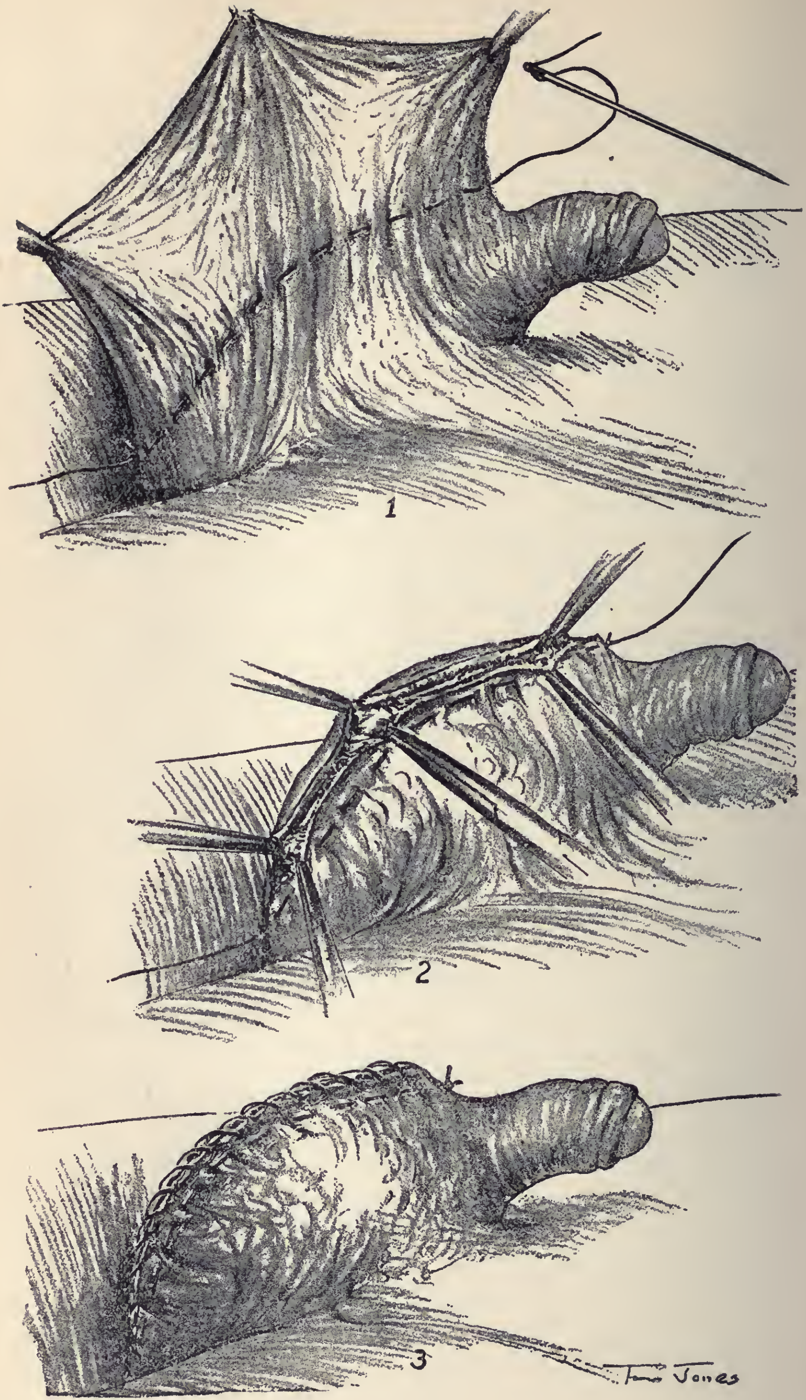

Fig. 202.

a globular hematoma which almost certainly prevents primary union. In one case I saw severe hemorrhage six hours after such an operation.

The method I advocate avoids all these objections and saves much time. It is a substitute for the old varicocele clamp in the form of a double suture line, the first or upper row of stitches being placed about 1.5 or 2 cm. above the cut edges. This is inserted by a single through-and-through mattress or trocar needle in loops about 2 cm. apart, the mattress stitch alternately appearing on each side. For a time I used a double mattress or shoe-lace stitch, but abandoned this because it sometimes strangulated the distal segment and caused it to slough off. The single back-and-forth mattress suture line leaves each segment of the sewed skin with a vascular pedicle. This line of continuous deep or retention stitches should begin at the perineum and end at the root of the penis, supporting and crowding upward the testis and marking off three-quarters or more of the scrotum below. It acts like a curved clamp and is intended to support the superficial stitch line, which is later inserted. Plain catgut is durable enough for this purpose.

The next step is the amputation of the part below, which is done with the scissors or knife in a sweeping curve 1½ or 2 cm. below the first stitch. The wound edges are held firmly together by the neighboring stitches, but it is at once noticed that numerous large vessels bleed freely—usually half a dozen spurting arteries and some large gaping veins. This is one merit of the operation, that it allows these vessels to be seen and ligated individually, whereas with the clamp they escape and retract into the loose dartos. When each bleeding-point is carefully secured, the skin edges may be rapidly brought together with small plain catgut stitches. These edges are, in fact, already together and only need to have their outer edges neatly turned into good contact. This system of double suture line is of great value in all plastic

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Fig. 202.—Varicocele case: *1.* Redundant scrotum stretched and mattress-suture inserted. *2.* Scrotum removed 1.5 cm. below mattress-suture. Bleeding vessels ligated separately. *3.* Skin closure completed by light running suture of distal segment.

surgery. Here it almost never gives anything but quick and sure primary healing. The ridge-shaped suture line stretches or flattens out in a week or less by the absorption of the catgut, at which time the cuticular union is smooth and strong. In some cases a collodion seal is all that is needed after the oozing of the first few hours.

CLINIC OF DR. CARL BECK

NORTH CHICAGO HOSPITAL

TREATMENT OF OBSTINATE SCIATICA

Summary: Necessity of ascertaining the cause of the pain before attempting curative treatment; stretching the sciatic nerve—danger of producing motor paralysis; technic of the treatment of a case of intractable idiopathic sciatica by prolonged nerve-stretching without open operation.

THE treatment of sciatica in most instances is non-surgical, and must, of course, vary in accordance with the pathologic conditions at the base of the symptoms. For instance, a continuous pain along the sciatic nerve due to pressure from a tumor will require treatment different from that which relieves the spasmodic attack of pain due to acute rheumatic trouble. Treatment applicable to a case of alcoholic neuritis will not be suited to a patient with syphilitic inflammation of the nerve-trunk leading to the same complex of symptoms, and the treatment of sciatic inflammation due to infected tonsils will again require different therapy. In other words, treatment must always be appropriate to the etiologic factors concerned in each individual case. There are cases of pains along the sciatic nerve in which the etiology is not clear. Pains which are persistent and resist any of the usual treatments, such as bathing, electricity, hot or cold applications; resist even semisurgical measures, among which may be mentioned injections of salt water or alcohol along the sheath of the nerve, cauterization of the skin, or counterirritation with other agencies.

Formerly we used to see a great many cases of sciatica treated according to a method which was introduced by Hueter, a German surgeon, active during the 80's of the last century. This procedure consisted in the stretching of the nerve. The sciatic nerve can be stretched in either one of two ways. We find that if we take hold of the leg while the patient is flat on his back and flex it at the hip, while the knee-joint is kept in extension, we can exacerbate a pain in the sciatic nerve even to intolerability. This is one of the diagnostic points which we often use to distinguish sciatic-nerve affection from other conditions with which it may easily be confused, such as hip-joint disease or coxitis. The pain is increased by this procedure because the nerve is stretched.

Older surgeons will remember the operation which we used to do in obstinate cases, which consisted in laying bare the nerve in the gluteal region, hooking it up with the finger, of course under anesthesia, and raising it up as high as possible under a tension of 15 to 20 pounds. This procedure was based upon the physiologic fact that the transmissibility of impulses by a sensory nerve is reduced considerably by stretching of the nerve-fibers. One may even produce motor paralysis if one becomes overzealous when stretching the sciatic, but function will return after a time. The sensory nerve can be easily affected for a long time, and, while sensation returns, pain transmission is gone for a long time, while the reactive inflammation which takes place, due to the stretching process, may remove inflammatory changes along the nerve and thus cure a case of persistent neuritis permanently. In fact, quite a number of cures in cases of sciatic pain resistant to other measures have been reported following nerve-stretching.

Twenty to twenty-five years ago I used to do a number of such operations. They are surgically easy, although not harmless, and if one does not use discretion in stretching, as we said before, total paralysis may follow such a procedure. As a rule, however, it does not. Although my results in those early cases were satisfactory, I have not met with many instances in the last fifteen or twenty years in which I have felt justified in carrying out this very radical treatment. Most of my cases lately have yielded to diathermy, high-frequency currents, subcutaneous salt-water injections, and other conservative procedures, although I have met with a few extremely obstinate instances, among them the case which I shall demonstrate to you this morning.

This patient, a young man, born in Russia, a very bright and successful individual, developed a sciatic pain, which gradually grew in intensity to such an extent that he would roll on the floor with pain when the attacks overtook him. This trouble persisted for months in spite of the numerous lines of treatment which were tried. The patient went from doctor to doctor, dispensary to dispensary, hospital to hospital, until he finally came to fear that nothing except the amputation of his leg would do him any good. His tonsils and adenoids were removed, his teeth were overhauled, and no pathologic condition could be found to explain the sciatica.

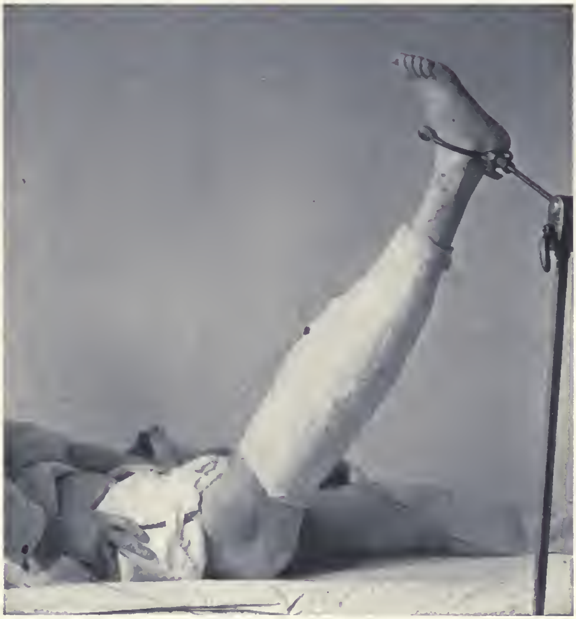

Fig. 203.—Position of patient undergoing treatment for intractable sciatica. A wire connects the plaster cast on the outstretched leg with a similar cast about the hips. This wire can be shortened and lengthened at will. Additional support in this case is furnished by a special supporter instead of by a roll as usual.

I decided to give this case a trial by a method which I had used successfully in a number of cases before. In this particular case of extremely severe sciatica it has now given complete relief for weeks, so that the young man, who had lost his position and his livelihood, is now beginning to work again, and has absolutely no sensation of the former pain in his sciatic nerve.

The treatment was as follows:

The patient's leg was put into a plaster cast in a perfectly extended position, and then, while the trunk was held flat on the table, back down, the leg was raised from the table, flexed at the hip, and suspended on a roller, just as we do in the treatment of fractures of the femur in children, or fastened with a wire to a plaster ring around the abdomen (Fig. 203). He was not able to stand this at first for longer than about fifteen to twenty minutes, and had to be relieved for about the same time. Gradually he became able to endure the position of flexion for an hour, and, later on, for more than an hour, and gradually also he was able to increase the degree of flexion, until ultimately he could keep his leg for a day in quite a flexed position, and his pain disappeared. This was the time when we had to watch closely for evidences of diminishing sensation in the part. The threshold for sensory stimuli applied to the skin became higher and higher; the distance between the points of the sensitoscope became larger and larger, and finally definite anesthetic areas could be outlined. The patient was still able to move his toes. Then we gradually reduced the duration of the periods of flexion and allowed the patient to sit up and to walk. Sensation gradually returned. Within ten days under this treatment the patient became free from pain and was able to walk on his leg without any trouble. This has been my experience in most instances of intractable idiopathic sciatica which I have treated by this method. This man had been taking anodynes, but he is now free from pain and takes no medicines. There is still, weeks after the termination of the treatment, numbness in his foot and along the fibular region of the leg.

CLINIC OF DR. DANIEL N. EISENDRATH

Cook County Hospital

GUNSHOT WOUNDS OF THE SKULL

Summary: A patient with a penetrating wound of the skull produced by a revolver bullet; types of gunshot wounds of the skull; opinions of English, French, and German surgeons; complications—hernia cerebri, edema, hemorrhage, infection; streptococcus encephalitis; brain abscess—danger of rupture into ventricles with resultant basal meningitis; treatment—indications for operation; management of the complications.

You remember some weeks ago we took up the subject of fracture of the skull in its relation to contusion, concussion, and compression of the brain. I showed you a number of cases illustrating the different types of concussion and contusion. I want to take up with you today another subject in relation to the skull which has come to be of tremendous importance in war surgery—namely, gunshot wounds of the skull.

This boy, nineteen years of age, was brought to the hospital on December 13th, forty-eight hours ago, at about midnight. The history was that he had made an attempt at suicide by shooting himself with a revolver. He entered the hospital in a semicomatose condition. The examination revealed a wound of entrance in the temporal region on the right side and a wound of exit in the median line close to the junction of the parietal and occipital sutures. This is called a penetrating or through-and-through variety of gunshot wound to distinguish it from the two other classes, namely, the tangential, in which the bullet plows a furrow along the course of the vertex, and the punctured or depressed variety, which causes a localized injury of the skull. In this case both the wounds of entrance and of exit are relatively small, and the x-ray shows only a slight splintering of bone at the wound of exit (Fig. 204). But we also see a condition which is very frequently a complication of gunshot injuries of the skull, and which in this case is well marked at the wound of exit, namely, a prolapse of the brain or a hernia cerebri. This is due to acute edema of the brain as a result of the laceration and contusion of the brain tissue. Such a prolapse may be of a relatively innocent nature when infection is not present, as seems to be the case here. It is covered with granulation tissue, and unless infection supervenes epidermization takes place from the surrounding scalp, bone tissue rapidly forms from the skull, the prolapse recedes, and is soon covered without leaving much of a defect in the skull cap.

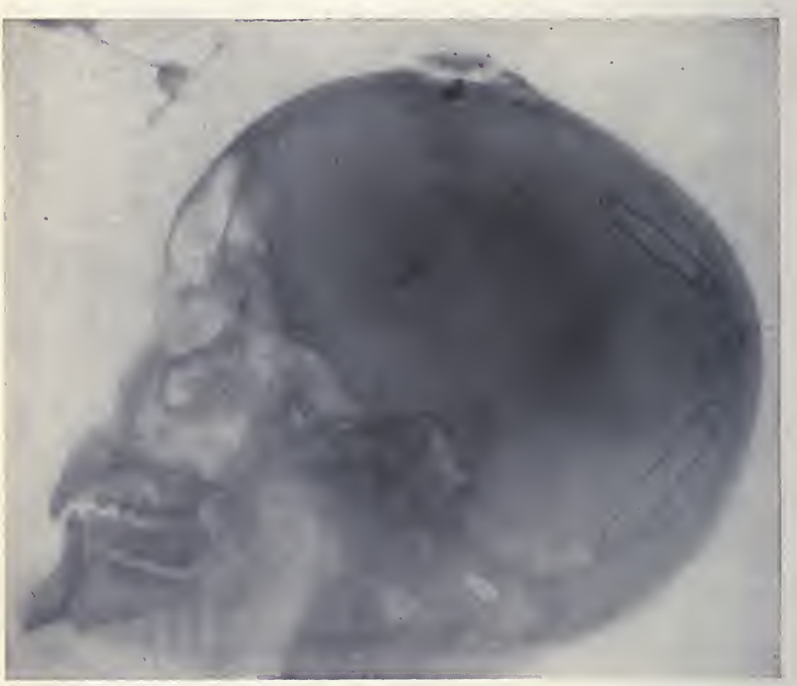

Fig. 204.—Gunshot injury of skull. Revolver bullet entered right temporal region. The wound of exit is seen at middle of vertex. Note comminution of skull at point of exit of bullet and particles of missile in track through brain.

In the case before us the patient has developed a facial paralysis on the left side and considerable ecchymosis of the right eye. Let us see if we can demonstrate the facial paralysis.

One of the best methods of doing this in patients who are semicomatose is to make pressure over the supra-orbital notch on the paralyzed side. You will note that the left side of the face does not move in response to this procedure, while the right is drawn up as though the patient were grinning.

This patient's temperature has risen as high as 101.6° F. and he appears very stuporous. When he first entered the hospital his mental condition was much worse than at the present time; he now comprehends questions and directions. Upon entrance the pulse was 156, very rapid and weak, as a result of a considerable degree of concussion of the brain, but this has gradually receded until it now averages about 76. Respirations are normal. Such symptoms indicate that there is no cerebral compression, because if there were compression his pulse would come down to 40 or 60. If he had a compression as a result of a laceration of the middle meningeal artery his blood-pressure would likely be high. If he were suffering from a compression plus a contusion, what would be the condition of his spinal fluid by lumbar puncture? It would be under increased tension and probably would be bloody. What do you suppose the symptoms which he came in with are due to? To concussion. Supposing that you were called to see this man, and upon examination you found the patient in a stuporous condition, with a pulse of 100, and a left-sided facial paralysis but no paralysis of the extremities, what—remembering that it is not only the skull injury that is of importance but more so that of the intracranial contents, especially the brain—would be your treatment and prognosis? You have given us the diagnosis, that is, cerebral concussion. He has no signs of compression and no signs of contusion, although from the apparent course of the bullet there must have been some destruction of brain tissue. You will be guarded in your prognosis. You would say that if this boy does not develop evidences of infection within the next forty-eight hours—and remember a cerebral infection shows itself within forty-eight to seventy-two hours—his prognosis as to life is excellent. What is your prognosis as regards the facial paralysis? That will recover just the same as muscle regenerates.

The muscular power will not be as good as before, but there will be substantial improvement. The prognosis is not as good with gunshot wounds as with cerebral contusion due to blows, etc., but I would not give an absolutely unfavorable prognosis. The indications for interference are two: First, signs of compression of the brain; and, second, evidences of actual or threatened sepsis.

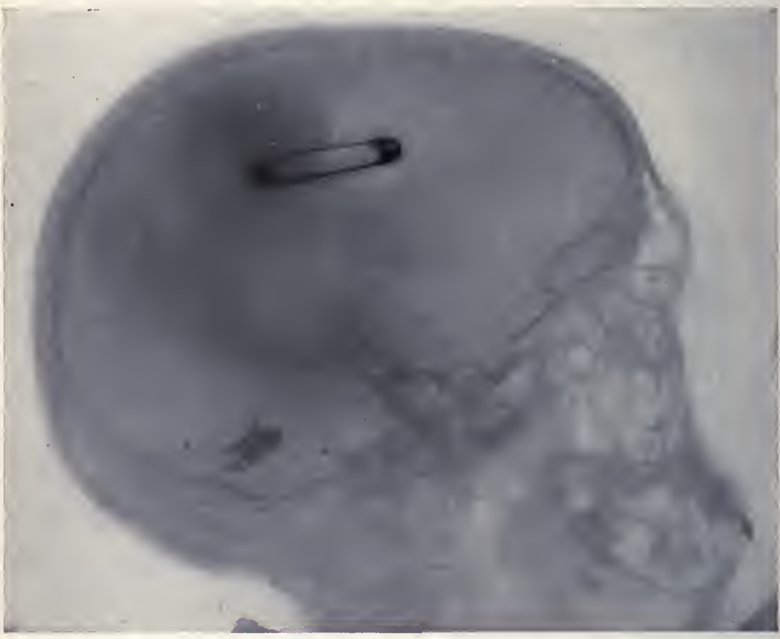

Fig. 205.—Gunshot injury of skull. Penetrating (revolver) wound of skull and brain. Bullet lies (fragmented) in posterior fossa of the skull. No symptoms.

In this case we have made up our mind that we are not going to operate. Is this hernia cerebri a serious matter? I do not think so unless an infection occurs. If we keep it clean, it will gradually recede. The treatment then will be to clean the wounds and keep the patient at rest in bed, under what we would call "watchful expectancy." Keep him quiet, with the assistance of morphin and bromids if necessary, until the effects of the cerebral contusion are over.

It is advisable to take an x-ray of these cases as early as you can in order to see the extent of the injury and to find the location of any foreign particles, such as bullets and, in wounds received on the battlefield, particles of shell. Wounds in war are seldom as clean cut as these unless they are made by machine-gun bullets. If there are particles of bullet or bone that can be easily seen in the wound take them out, but do not go deep into the brain proper (Fig. 205).

I have read a great many articles during the past two years written by the most distinguished surgeons of the various countries now at war in Europe. Their views in regard to the surgery of gunshot wounds of the skull have undergone a complete revolution. This is especially true of gunshot wounds of the skull because of the trench fighting and the difference in the character of the weapons used in the present war as compared with former wars. In order to acquaint you with the most important facts brought out in these articles I shall quote some of the principal contributions from the English, German, and French publications.

The articles of Whitaker,[1] Trotter,[2] and Sargent and Holmes[3] are the most important ones from the standpoint of the English army surgeons. Whitaker advises immediate operation in practically all cases seen within the first three days. Early decompression (which is secured by excising the injured or septic area of the scalp and enlarging the skull defect until $\frac{1}{2}$ inch of normal dura is exposed) is the best method of preventing a prolapse of the brain. This is especially true of penetrating injuries when the wounds of entrance and exit are situated close together. No prolonged search for projectiles or small bone splinters should be made, as the latter are often extruded spontaneously. Roentgenographic examination is very desirable, but is not always to be obtained. Whitaker distinguishes between streptococcus and staphylococcus infection. In the former there is a tendency for the infection to spread rapidly in all directions; a prolapse if present will become very large, the adjacent brain undergoes necrosis for a considerable distance, and meningitis spreads rapidly from the injured area. Invasion of the lateral ventricle is not as common as in staphylococcus infections because the latter tend to produce localized abscesses which, in turn, are apt to burrow, so that the ventricle is likely to be invaded through a narrow tract where the wound in the brain is deepest and approaches the ventricle (Figs. 206 and 207). The relation of the areas of infective encephalitis to ventricular invasion, causing death after an interval of days or weeks, is one of the most important contributions to the surgery of gunshot injuries of the brain, and is frequently referred to by German writers.[1]

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[1] British Jour. Surg., 1916, 3, 708.

[2] Ibid., 1915, 2, 520.

[3] Ibid., 1916, 3, 475.

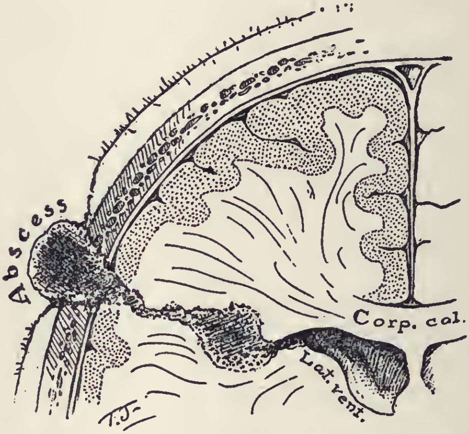

Fig. 206.—Abscess near surface of brain causing prolapse and invading brain tissues as far as wall of lateral ventricle (Fritz Mueller).

In cases not seen for fourteen or more days Whitaker advises expectant treatment unless the roentgenogram shows splinters of bone driven into the brain. In the intermediate period (seven to ten days after the injury) operation is indicated by (*a*) active sepsis in a badly drained wound, (*b*) signs of cerebral irritation, *e. g.* convulsions, restlessness or delirium; (*c*) symptoms of cerebral compression, such as severe headache, coma, and slow pulse.

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[1] Infection in Gunshot Injuries of the Head, Beiträge z. Klin. Chir., 1916, 100, 618, Burckhardt.

If acute and active scalp infection is present, the scalp should be thoroughly drained for twenty-four hours if possible before the decompression is done. Cases with clean scalp wounds but with depressed bone fragments or foreign bodies of moderate size, which have been localized and are not doing any damage, can be operated at the convenience of the surgeon.

Operation in the intermediate stage (seven to ten days after injury) is contraindicated (*a*) when there is no displacement, sepsis, or foreign body; (*b*) when no evidence of sepsis is present, but with a foreign body not causing progressive symptoms; and (*c*) if a primary operation with free drainage and sufficient decompression has been done. Whether one should operate or not is a question when (*a*) the general and local conditions appear to be hopeless; (*b*) if patients who have been operated upon become dull and apathetic, Whitaker believes that in such cases hemorrhage into the ventricles has occurred without primary infection, and that there is danger of secondary invasion of the ventricles after a considerable period and with a fatal outcome, as the result of a staphylococcus encephalitis. (*c*) Cases with external wounds healed but with a foreign body difficult to reach, and with symptoms of grave cerebral contusion but not compression. Operation will be of no benefit in this last-named class of cases.

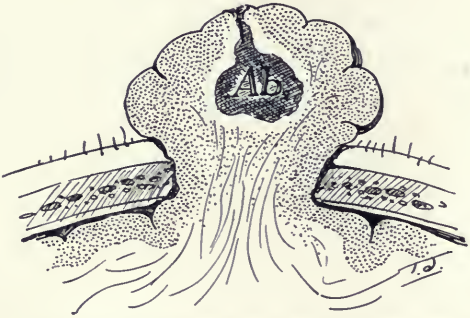

Fig. 207.—Hernia of brain with abscess in prolapsed brain tissue.

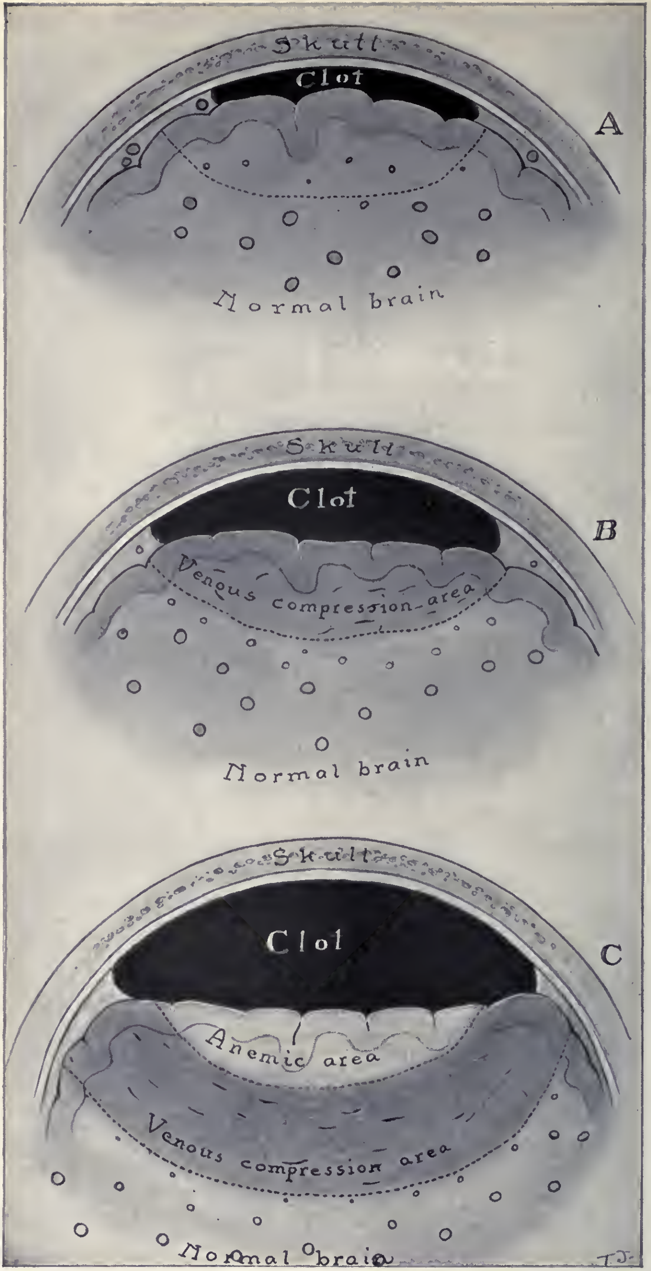

Fig. 208.—Scheme to illustrate the circulatory changes accompanying an intracranial (subdural) hemorrhage. (From Trotter, British Journal of Surgery.)

Trotter agrees with the majority of French and German surgeons that an extra- or subdural clot does not destroy the brain unless its presence is prolonged, hence the outlook is hopeful. Other causes of compression are fracture and the transit of a bullet. In his article Trotter shows an excellent diagram (Fig. 208) to illustrate the circulatory changes which accompany an intracranial subdural hemorrhage. He also gives a splendid review of the physical effects of a gunshot injury of the brain, which are considered under the following headings: First, those due to deformation of the skull, either generalized or localized (Fig. 209); second, those due to the transit of the bullet, the chief factor concerned in regard to the latter being its velocity. This is well shown in Fig. 210. The intracranial contents act as a homogeneous medium and not as in hemorrhage

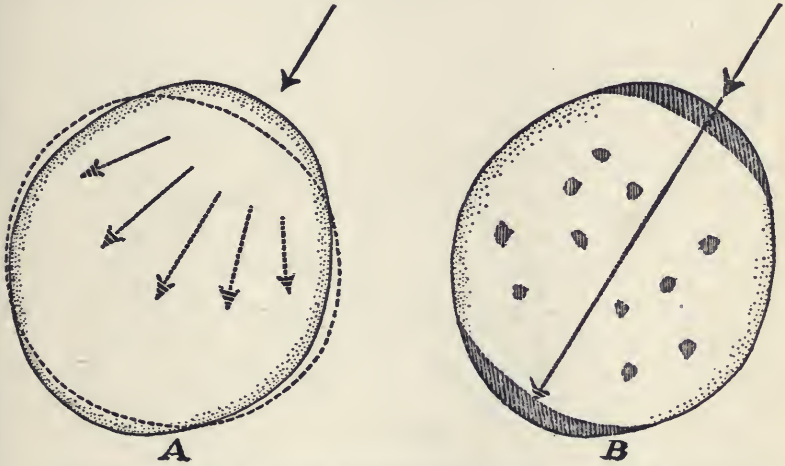

Fig. 209.—Diagrams to show the distribution of force within the skull when the head strikes a flat surface and sustains injury by deformation without direct fracture (Trotter): *A*, The factor of hyperacute compression. A general deformation occurs; the skull tending to assume momentarily the form shown by the dotted line. The effect is to produce a sudden encroachment upon the intracranial space and wide-spread momentary capillary anemia. *B*, The factor of the impact of the skull on the underlying brain. At the point struck direct contusion is produced; diametrically opposite polar contusion. Between these two are scattered foci of contusion of the brain substance. The lesions are indicated by the shading.

by displacement of intra- and extravascular fluids in the order of their pressures. Third is the question of the injuries associated with localized fractures or those inflicted by small or pointed objects, fragments of shell, and tangential wounds. In these cases one is apt to underestimate the extent of brain damage owing to the relative absence of concussion and compression.

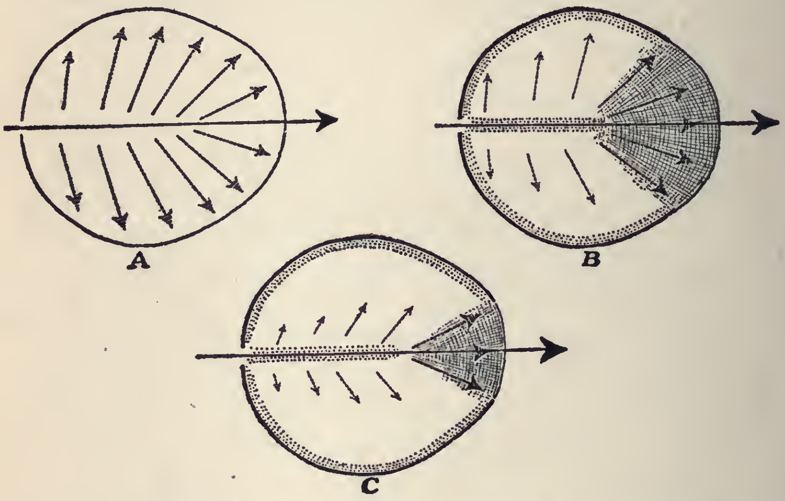

Fig. 210.—Diagrams to show mechanical effects of a high-velocity bullet wound of the skull with complete transit of the bullet (Trotter): *A*, At very close range. The energy of the bullet is distributed throughout the skull, most powerfully in the direction of the shot, but powerfully enough from the moment of entry to produce a general bursting effect over the whole skull. *B*, At submaximal velocities. The energy yielded by the bullet falls off first near the point of entry, and is most marked in the direction of the shot—as shown by the length and thickness of the arrows. When the distributed force is relatively small the skull remains intact (thick outline), but the brain is apt to be contused against it (shading). Where the distributed force remains very great the skull is liable to bursting (thin outline), and the brain to disorganization (dotted area). The contusion along the bullet track is moderate in amount. *C*, At a less velocity. The mode of distribution of force remains the same, but the amount of destruction is less. The greatest damage is still found in the region of exit of the bullet.

The physical effects produced by the mechanism just described are: first, a direct destructive effect upon the brain; second, reactionary swelling which we speak of as acute cerebral edema; third, hemorrhage, the clinical types of which are characterized by signs of grave and extensive hemispheric compression, by obviously grave injury without localizing signs, or by signs of cerebral irritation which overshadow everything else; fourth, a localized cerebral lesion due to cortical hemorrhagic contusion; fifth, compound depressed fracture. In the latter class, even though there is only a very small punctured wound of the scalp, the brain may be injured even in the absence of symptoms of concussion. Foreign substances have been driven into the brain in a majority of these cases, hence it is necessary to take a roentgenogram at an early period. Late cases may have cerebral symptoms due to the accumulation of blood or pus. All cases in which the skull has been penetrated demand operation whether they present cerebral symptoms or not in order to limit sepsis, remove foreign bodies, and provide for the escape of blood and disorganized brain tissue. If such cases are treated expectantly there is great danger, first, of spreading infections of the brain and meninges starting from the collection of pulpified brain, blood, fragments of bone, and foreign substances which are apt to be retained in the wound, and, second, if there is no suppuration and the wound heals the function of the brain is likely to be interfered with from the retention of such materials. Deeply located bullets or foreign bodies should be left. The wound should be dressed widely open. Even if the patient comes late after the infective conditions have developed the same treatment should be carried out. Wet dressings are preferable to dry.

There is complete unanimity of opinion among the majority of prominent British surgeons who have written on gunshot injuries of the skull received in the present war, that no penetrating injury, especially if seen early, should be treated without a thorough cleansing of the wound and early decompression.

Sargent and Holmes do not agree with the above practices. They believe, as do some of the German surgeons, that operation is almost always necessary in tangential and punctured (depressed) injuries because of the number of bone fragments and foreign bodies which have been driven into the brain. Operation, on the other hand, is seldom indicated in penetrating (through-and-through) injuries. In their experience the cerebral edema which follows gunshot injuries is rapidly recovered from if infection does not occur. As in civil practice, the extent of the injury to the brain is of far more importance than that of the skull. They divide the injuries into superficial and deep, the latter only requiring drainage. The depth of the injury can be determined by the mode of infliction, the appearance of the wound, the roentgenogram, and the neurologic symptoms. The latter seldom if ever call for operation at an early stage and less so at a later one. If progressive hemorrhage causes compression, operation should be performed, but if the symptoms of compression are due to edema, only lumbar puncture is indicated. Sargent and Holmes also advise against operation until after three to five days so that adhesions between the various injured tissues may have time to form.

In these two respects they differ from the majority of other surgeons on both sides, who strongly advocate early decompression in all cases and who do not fear the absence of adhesions around the area of injury. Burckhardt and others have called attention to the fact that a meningitis from the original wound is comparatively rare, and that infection spreading from the track of the projectile into the lateral ventricle with resultant basilar meningitis is far more to be feared than a convexity meningitis. Early operation, therefore, will relieve the cerebral edema if noninfective and will permit drainage toward the surface instead of toward the ventricle.

Sargent and Holmes believe, as do all others who have written on the subject of war surgery, that a stereoscopic roentgenogram is indispensable, and also that one should not search for foreign bodies unless they are near the surface. The finger is the best instrument for removing bone or shell fragments, and they prefer a perforated metal tube for drainage. They believe that lumbar puncture is one of the most valuable aids in relieving cerebral edema and controlling the tendency to prolapse. I have called attention above to the divergence of opinion on this subject, the majority of writers placing little if any reliance upon lumbar puncture as a therapeutic measure. Many of the early disturbances of function disappear, since they are due to concussion, cerebral edema, and compression of vessels rather than to local brain destruction.

Bleeding from the longitudinal sinus is best controlled by packing with muscle. Improvement after injuries of this sinus are slow, but the outlook is very encouraging.

The most important contributions from the German side were read at the first and second War Surgical Congresses held at Brussels in 1915 and at Berlin in 1916. Those especially interested will find a series of issues of the Beiträge zur Klinischer Chirurgie[1] devoted to war surgery a very valuable addition to the literature from the German side.

Tilmann[2] called attention to an important observation at the first War Surgical Congress in Brussels in 1915, viz., that the inner table may be extensively comminuted and the brain much contused, even though the outer table is intact. This is especially true of tangential injuries, more so than in the depressed or punctured variety. Through-and-through (penetrating) cases usually die at once, and those who survive show much comminution at the wounds of entrance and exit. If the latter are small, the case may be treated expectantly, but if large, operation should be done early. Tilmann's views concerning the effects of hemorrhage are in accord with those of English surgeons, that there is more danger from infection and acute cerebral edema than from intracranial bleeding. A high temperature may be indicative of absorption and not of infection. A non-infective encephalitis (acute cerebral edema) may at times be followed by softening of the brain (encephalomalacia).

One of the most important contributions to the subject of infection in war injuries of the brain is that of Burckhardt.[3]

Burckhardt says that antebellum views have been completely changed. Many patients who survive the immediate effects of the injury succumb from a suppurative meningitis after an interval of a few days to many weeks. He has confirmed the observations of Chiari[4] that such sudden deaths are, as a rule, due to the extension of an area of suppurative encephalitis into the lateral ventricle. Autopsies show the dura adherent to the skull and very little if any evidences of meningitis in the vicinity of the original injury. The meningitis is most marked at the base, due to an extension from the ventricle, and in the latter one can see how the area of encephalitis has involved the wall of the ventricle. Direct penetration of the ventricle by a bullet is much less frequent than by splinters of bone, especially in tangential injuries.

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[1] Beiträge zur Klinischer Chirurgie, Bd. 96–101. Chirurgische Kriegs Hefte.

[2] Ibid., 1916, 100, 618.

[3] Ibid., 1915, 96, 454.

[4] Münch. Med. Woch., 1915, 62, 596.

The clinical pictures of two general types are familiar to all. The first is characterized by rapid recovery in the beginning, with restoration of consciousness and improvement of the pulse, followed on the third or fourth day by a sudden or a gradual rise of temperature and death in from one to three days. In the second type everything seems to go well; fever, if present, decreases, focal symptoms recede, the patient may even have left his bed, or a prolapse may have formed which is being covered with granulations; when suddenly, after weeks, headache appears, the patient becomes depressed, shows symptoms of cerebral irritation, and may even become maniacal. At the same time there is a rise of temperature and the classical symptoms of meningitis, such as rigidity of the neck, etc., appear to be followed shortly by death. There is still another way by which a late infection of the ventricles may occur—a wound in the brain, whether it stays flat or whether a prolapse occurs, contains at its surface many necrotic masses of brain tissue. When these are desquamated the ventricle may finally be opened and a fistula discharging cerebrospinal fluid produced through which the ventricle is infected.

Meningitis due directly to the injury or to the operation is very rare in Burckhardt's experience. He warns against careless puncture for abscess or too prolonged use of a drainage-tube, as both of these may be followed by ventricular infection. Extensive involvement of the frontal lobes gives a better prognosis than similar involvement of other parts of the brain because of the fact that the ventricles do not extend far into them.

Prolapse of the brain is due to a lack of space within the skull and may be composed of either disintegrated or acutely edematous brain tissue. A prolapse occurring in war injuries is always, according to Burckhardt, an evidence of an infective edema of the brain. If the inflammation is of a mild character both it and the brain prolapse gradually subside. If an encephalitis exists the ventricle is at last involved and death occurs. If a brain abscess is present, recovery may occur if the pus is given an opportunity to escape externally.

The prolapsed edematous brain becomes covered with granulation tissue, which becomes firmer and is gradually covered by epithelium if the infection recedes. In a prolapse associated with a progressive disintegrating encephalitis the surface is covered by necrotic masses which may be desquamated, and thus lay open a diverticulum-like projection of the lateral ventricle which often extends into the prolapse. Such a process is followed by infection of the ventricle, meningitis, and death.

The prospects of success, after Burckhardt's experience of 306 cases, are greater in immediate operations. The only exceptions are smooth, penetrating wounds; in all other cases an operation may prevent encephalitis and brain abscess or will permit of drainage for an infected ventricle. The dura must be exposed until it appears normal and then incised until the entire area of disintegrated brain is exposed. Punctured wounds should be operated on by all means, because in an unexpectedly large percentage of cases it has been found that the projectile remains outside of the skull and can easily be removed, although it may depress the bone itself. An abscess which can be prevented by an immediate operation is very liable to form around a projectile and bone fragments which are allowed to remain in the wound. If the missile has penetrated the brain, suppuration is almost sure to occur if it is not removed, the exception being infantry bullets and bomb fragments less than the size of a pea. From Burckhardt's observations at autopsy and in the living it has been determined that, as a rule, a projectile does not stay in the midst of the brain tissue. Projectiles are often found either outside of the skull itself or in the opposite wall of the skull. Quite often the projectile will be found lying free in the cranial cavity (see Fig. 205). It is much better to wait until an x-ray has been taken than to do unnecessary damage by exploring the brain in vain. In no portion of war surgery does one need an x-ray as much as in punctured fractures of the skull because of the fact that missiles are not as often found within the brain substance itself as external to it, often on the side opposite to that of entrance. Only small bomb particles remain in the brain tissue.

In regard to the treatment of prolapse, the following principles are laid down: If a prolapse exists, one should operate. In acute prolapse, as a result of sudden closure of a cerebrospinal fluid fistula, enlargement of the cranial defect is always indicated to allow escape of pus from the ventricle. One must not expect a brilliant result from an operation for prolapse because it is really only a decompression. Under no conditions should a prolapse be amputated. To puncture a firm prolapse is dangerous because in both amputation or puncture of a prolapse one is apt to open a ventricle. Necrotic areas should be allowed to sequestrate spontaneously. An open-wound treatment is especially indicated in an encephalitis which is breaking down, and also in firm prolapses. Cerebrospinal fistulæ should be dressed daily. In regard to the bony defects, it is astonishing how much they will decrease in size. One should not do a plastic operation too early because the infection may not have subsided and a diverticulum of the ventricle may lie directly beneath the scar. If there are neurologic causes for a plastic operation it is sufficient time to do such a plastic after the symptoms have appeared.

For a long time it was believed that the encephalitis which caused prolapse was directly due to the projectile and the other foreign bodies which were carried in with it. The conclusion has now been reached that germs which are carried in only exceptionally lead to infection in cases of minor degree of destruction of the brain. The infection is predominantly a secondary one in these minor injuries which occurs after the operation. In large areas of brain destruction, on the other hand, the germs which are brought in at the time of the primary injury are the cause of the infection. Such cases cannot be saved and one should attempt in every way to prevent secondary infection.

V. Eiselsberg[1] made a report at the Second War Surgical Congress held in Brussels in April, 1916. He advises early operation, especially in fresh tangential injuries if external conditions are favorable and the patient does not have to be transported any considerable distance. If these conditions cannot be met, then he advises only that the wound edges be freshened and the largest bone splinters removed. He is strongly against complete suture without drainage as advised by Bárány.

In considering the treatment of skull and brain injuries, V. Eiselsberg divides them into three classes, the tangential, the segmental, and the penetrating. Although the transition from a tangential to a segmental and from this to a penetrating injury is a slight one, he believes such a distinction is advisable.

Tangential.—The patient should be *x*-rayed and studied for twenty-four hours. Absence of suppuration (much) as well as of general local symptoms in conjunction with a negative *x*-ray contraindicates interference. The patient should be reoperated at a base hospital, even though a primary operation has been done in a field hospital, if there is much wound secretion or marked mental disturbances, such as characteristic paralyses associated with retention of bone splinters in the wound as shown by the *x*-ray. In operating upon tangential injuries the bone should be removed until the periosteal elevator can be readily placed between the dura and the skull. The extent of brain injury is then determined by the use of the little finger and foreign bodies removed, and then several gauze strips, lightly packed, are inserted for drainage. If the dura does not pulsate, this indicates an abscess, and a small sharp bistoury should be used to incise the dura and explore for pus. If it is found, a rubber tube should be inserted for only twenty-four to forty-eight hours on account of the danger of pressure-necrosis into the ventricle. Death in these cases is due to a progressive encephalomalacia or to rupture into the ventricle. Perforation into the meninges is not nearly as fatal as into the ventricle. If meningitis exists, operation is of no avail. Lumbar puncture is of diagnostic and prognostic, but not of therapeutic value. Of 65 tangential injuries, 30 had abscess. Of these, 2 died. Of the 35 who had none, 11 died.

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[1] Beiträge z. Klin. Chir., 1916, 100, 59.

Penetrating Cases.—We are powerless against infection in the middle third of the tract of the projectile; although the majority of these cases end fatally immediately or after a short time, it is surprising to see some of them run a course without symptoms or reaction. Von Eiselsberg only operates on such cases if there are signs of progressive infection.

Contact or Punctured Cases.—These are best operated on in base hospitals unless there are very severe intracranial pressure symptoms. Although experience with suicide cases in civil practice has taught that the projectile will remain without reaction in a large percentage of cases, and as this view is still held by a number of surgeons, one must not forget that in these war wounds the projectile, especially if it is a large one, within the course of time causes abscess formation. Such an abscess may remain latent for a long period and then suddenly rupture into the ventricle. If the projectile does not lie superficial and cannot be easily removed, it is best to leave it, following its migration by repeated radiagrams. The advantages of this practice are two—*i. e.*, better encapsulation of the projectile and greater local immunization. Abscess of the brain may arise through primary infection of the injured area or be secondary to some other focus. The reason for so many failures is that we are powerless to deal with the encephalitis and inflammatory softening of the brain as well as with the meningitis and prolapse. The latter may be due to a deep-lying abscess, and when this is opened recovery occurs, or a prolapse may develop on the basis of progressive suppurative changes of the brain accompanied by an intense edema, and the latter may recede, but the prolapse progresses and leads eventually to death.

In 3 of 16 cases of late abscess there were no symptoms for from seven to ten months; 15 of these patients died; 2 were cases where the abscess developed after plastic operations. Von Eiselsberg prefers a free transplant from the tibia for closure of the defect in the skull, and used this in 20 out of 27 cases, while in 6 he used the König method.

Epilepsy associated with defects of the skull should first be given medical treatment, and if not benefited a plastic should be done, placing fat or using bone covered on both sides with periosteum.

Erdelyi[1] believes that brain abscesses may exist for weeks without symptoms. Fortunately, the majority are superficial and should be located with a scalpel. The best form of drainage material is a rubber tube, which should not be allowed to remain longer than forty-eight hours on account of the danger of pressure-necrosis with invasion of the ventricle.

The views of French surgeons are quite in accord with those of the English and German writers. Leriche,[2] Le Fort, and others advise early operation in all cases. If the dura is intact, it should not be incised.

Many of the German surgeons differ in this view from Leriche, and believe that if there is no pulsation of the dura it should always be incised, considering absence of pulsation a sign of abscess.

The experience of surgeons in the European War and of my own in civil practice may be summed up as follows:

(1) Gunshot wounds of the skull are best divided into the penetrating (through and through), tangential (furrow-like), and punctured (depressed) varieties.

(2) The penetrating variety does not require operation in either civil or war practice if the wounds of entrance and of exit are small. If the latter are large and especially if they are close together it is best to operate. The middle third of the canal made by a penetrating missile is most liable to infection from retained foreign bodies.

(3) All tangential wounds must be operated at as early a period as it is possible to secure the proper surroundings. Stereoscopic roentgenograms should be secured even if it is necessary to wait for twenty-four hours, but such an examination is not

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[1] Beiträge z. Klin. Chir., 1916, 100, 57.

[2] Lyon Chir., 1915, 12, 293.

indispensable. The appearance of the external table is no criterion of the degree of damage to the internal table in tangential cases. Remove all larger bone splinters and foreign bodies, using the finger for purposes of palpation. Do not bore around too much in the brain for deeply located bone fragments or foreign bodies.

(4) All punctured (depressed) fractures require immediate operation, the same technic being employed as in the tangential variety. Hemorrhage from wounds of meningeal vessels and of the sinuses is best controlled by pieces of muscle.

(5) The absence of symptoms of concussion and of compression in the majority of gunshot injuries should not lead one to believe little damage has been done to the brain. The reactive cerebral edema, non-infective in character in many cases, requires decompression, and the degree of so-called aseptic brain prolapse is an index of the extent of cerebral edema from the contused brain areas.

(6) Prolapse of the brain due to infection requires immediate enlargement of the skull and dural wounds. If such drainage is not secured, abscess of the brain occurs very early with rupture into the ventricle, and death at a late period from basilar meningitis. Such a sequel may also be due, after days or weeks, to an infective encephalitis advancing to the wall of the ventricle.

(7) A localized meningitis around the seat of injury is not as much to be feared as infection within the brain due to retained bone fragments and foreign bodies.

CLINIC OF DR. JOHN LINCOLN PORTER

ST. LUKE'S HOSPITAL

CALCANEOCAVUS: TENDON TRANSPLANTATION

Summary: Etiology, pathologic anatomy, and clinical characteristics of calcaneocavus; treatment—astragalectomy; tendon transplantation—the Gallie operation; after-treatment—points in the application of plaster casts.

January 9, 1917.

THE first case this morning is a calcaneocavus, the so-called "talipes cavus." This young woman had a poliomyelitis when she was four years old, and as a result of the poliomyelitis she has lost the calf group of muscles, and her heel has slowly dropped on account of the contraction of the plantar fascia and the short plantar muscles and the stretching of the tendo achillis. The deformity has resulted in a great deal of disability because the patient has to walk with a limping gait over the inside of the foot, being unable to lift the weight over to the toes. Remember that the soleus and gastrocnemius muscles are two of the most powerful muscles in the body, being assets in locomotion by lifting the weight off the ground at each step and transferring it to the toes. When that function is lost the patient is unable to lift the heel off the ground, and consequently, in order to carry the weight over the toes, has to walk over the inside of the foot. Sometimes the calcaneus is associated with varus or valgus, depending on whether the tibial muscles on the inside, or peronei on the outside, of the leg are active and functionating. For instance, if a patient has lost the calf group of muscles, and still has the anterior or posterior tibials active, he will have, besides the cavus, a varus, and the foot will be turned inward, which complicates the situation considerably. The patient will then have to walk over the outside of the foot in this way (indicating), because it is a physiologic law that when a muscle is paralyzed its antagonist contracts. In other words, if the muscles on one side of a joint are lost, the muscles on the other side of the joint will slowly contract until they have pulled the joint out of shape. The reverse is also true. If a patient has lost his anterior or posterior tibials, which are the supinators of the foot, but has strong peronei, he will have, besides the cavus, a valgus, which is an extremely disabling deformity, because the heel drops and the foot is turned outward and the patient has to walk on the inside of the foot. Sometimes the malleolus is clear down on the floor. Fortunately in this case the foot is well balanced. The patient is able to dorsiflex the foot and extend it, and able to supinate and pronate the foot slightly, and when the patient walks the toes go down flat on the ground, so that the only problem there is to deal with is to flatten the bottom of the foot and lift the heel and fix the tendon so the patient can put the foot flat on the ground and walk on the toes.

Various operations have been devised for this purpose. The first, and probably the most successful, is the *astragalectomy* of Whitman. Fifteen or more years ago Dr. Whitman, of New York, proposed taking out the astragalus and allowing the tibia and fibula to come right down on the os calcis. In doing that he advanced the leg a little, so that the internal and external malleoli should become fixed in a position slightly anterior to their former position, giving the patient a weight-bearing surface nearer the middle of the foot. Then the peronei, if they are active, are cut off and carried backward and attached to the tendo achillis. The operation has proved very successful, and it is used in many other deformities about the ankle besides the talipes calcaneus. There is one objection to the operation which we have not been able to overcome, and that is, it shortens the leg a distance equal to the thickness of the astragalus. In a case where the leg is already short, which is usually the case, because these paralytic legs do not develop as fast as their fellows, and consequently one leg is almost always shorter than the other, this makes an additional shortening. If we can relieve the deformity without shortening the leg any more it is a very wise plan to do so. In 1912 Dr. Gallie, of Toronto, proposed an anchoring of the tendo achillis to the tibia, the same as you anchor other tendons to the bone in different deformities to prevent a distortion of the joint. The leg in this case is so much shorter than the other leg and the heel apparently can be brought up to a fairly normal position, so I am going to use Dr. Gallie's operation instead of Whitman's, as a matter of choice, with the idea of preventing any further shortening.

I told you a few minutes ago that it is a physiologic law that unopposed muscles contract and shorten up. It is also a physiologic law that paralyzed tendons stretch very easily and become overstretched, and in spite of the fact that the patient has been walking on the foot with the heel on the ground ever since she was paralyzed, the heel has slowly dropped, so that now the os calcis, instead of pointing horizontally as it should, points obliquely upward, and the posterior surface of the os calcis, instead of pointing backward, points slightly downward toward the ground, and the object of the operation is to lift the heel up in this position by anchoring the tendon into the bone so close to the insertion in the os calcis that it cannot stretch. It makes a strong ligament or guy rope of the tendon instead of a long, elastic support which is easily overstretched.

Ordinarily in a normal foot, with the patient lying in that position, you can see the tendo achillis sticking up prominently under the skin, and when the foot is dorsiflexed the tendon becomes tense. In this case the posterior angle of the ankle looks flat, and when I lift the foot in dorsiflexion I cannot even feel the tendon under the skin with my finger.

OPERATION

The incision we use is a long one, just to the outer border of the tendon, extending down to the insertion of the tendon in the os calcis. A constrictor is put on preceding all these tendon operations because it facilitates the work very much to have no bleeding. The only thing you have to avoid is the short saphenous vein, which runs along up the inner border of the tendon, and the saphenous nerve which accompanies it. They are very easily avoided.

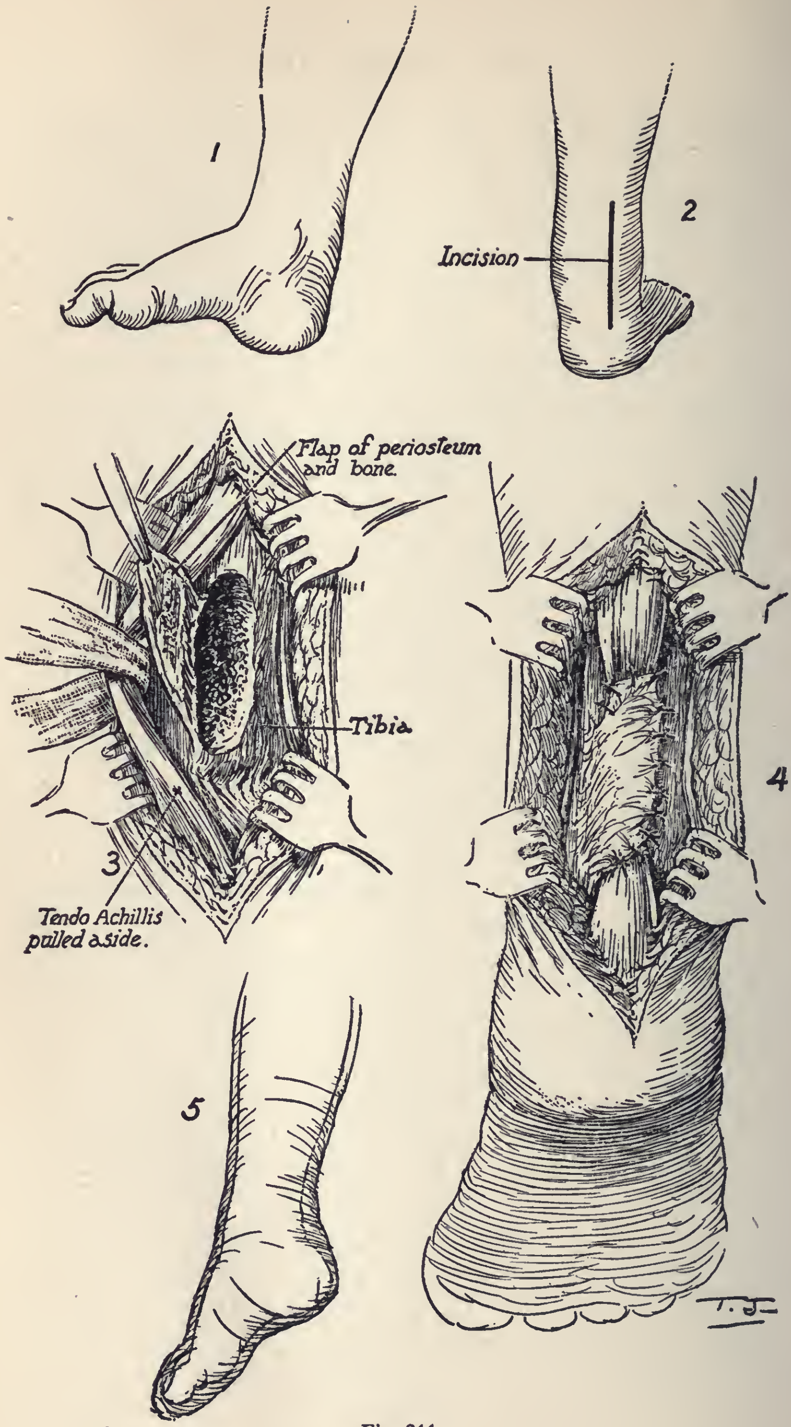
1
2
Incision
Flap of periosteum and bone.
Tibia
3
Tendo Achillis pulled aside.
4
5
T. J.

Fig. 211.

One thing the originator of the operation laid particular stress on is the desirability of completely denuding the tendon, not burying it with the sheath; so in exposing the tendon we try to get inside the tendon sheath and expose the bare tendon. The operator also scarifies the tendon in various places, so that when it is buried in the bone the fibers of the new bone may go right into the tendon, so that the tendon becomes a part of the bone, and in that way so firmly fixed that it cannot move.

You see the long plantaris tendon that comes down along the inside of the tendo achillis. Now this tendon is isolated. We will just put it out of the way temporarily while we cut down to the muscles which cover the posterior surfaces of the tibia. Right here we ought to find the bellies of the flexor longus hallucis and the tibialis posticus. They are quickly seen and separated. Now the attachment of the flexor longus hallucis at the lower end of the wound has to be lifted loose from the tibia for a little way. That is the posterior ligament of the ankle-joint. There is the lower end of the tibia. Now I must make a channel in which to bury this tendon. In the original article Gallie advised simply peeling up the periosteum and sewing it back over the tendon after it is buried in the groove in the bone. In his later article he advised lifting up a little flap of bone with the periosteum on it, as this makes a harder and more durable covering over the tendon. In order to get the canal deep enough to put the tendon in and hold it we go practically down to the medullary canal. You see I have made the canal in the posterior surface of the tibia, going down through the cortex to the medulla. Now we will take the tendon, and with a curved forceps Dr. Piper will hold it down in the groove, at the same time pulling upward on it, while Dr. Mitchell pushes up the heel with this club-foot wrench.

This instrument was devised by Dr. McCurdy for the cor-

Fig. 211.—*1*, *2*. Character of the deformity and location (*2*) of the incision to the lateral side of the tendo achillis. *3*. Soft tissues retracted, osteoplastic flap raised, and deep trough made in the bone. *4*. Tendon anchored in the trough; osteoplastic flap stitched back in place, burying a segment of tendon. Note that the heel is kept well elevated during this procedure. *5*. Operation completed. Foot dressed in plantar flexion with the heel lifted upward as much as possible and immobilized with plaster cast.

rection of club-foot. You can get a hold on the foot in almost any position and use enormous leverage in twisting it in any direction. As a matter of fact, the more I treat club-foot, the less I use the wrench. We used it a great deal years ago, but very little now. Now, you see, the doctor has the tendon buried in the bone for about 2 inches. I am going to sew that flap of periosteum and bone right over the tendon so it will be buried in the bone.

Now I pass this stitch through the posterior capsule and the periosteum. Now we pass it through the tendon at a little lower level than the place where I want to sew it, and then come up through the periosteum and bone on the other side. This first stitch is simply to anchor the tendon down in the lower end of the groove that we made for it. We then put in another stitch on the other side and come out through the periosteum in the other direction. The lower end of the tendon where it goes into the canal has a bone-flap sewed right over it with the periosteum. We use kangaroo tendon and catgut for sewing the tendon and subcutaneous tissues, and black silk for the skin. If you ask me why I use silk for the skin, I do not know, except that I have been using it for three or four years. I stopped using silkworm-gut because it was so stiff it did not nicely approximate the edges, and started using silk, and have been using silk ever since. Now the tendon is buried and covered and we will take off the constrictor.

There will be a little oozing from the bone, but not enough to amount to much. Wherever you go through the cortex of the bone there is always some oozing for a few minutes, but we have not injured any blood-vessels of any size, and the bleeding is light and quickly stopped with a hot sponge pressed into the wound. The deep fascia is now sewed over the tendon and the muscles with a running stitch of small catgut. Then the skin incision is carefully and accurately closed with silk. After the gauze dressing is put on, the foot and leg up to the garter-line are enclosed in a plaster-of-Paris cast, with the foot plantar flexed and the heel lifted upward as much as possible to prevent tension on the tendon and periosteum.

In putting on the plaster cast there are several points to which I might call your attention which make for the comfort of the patient and the success of the operator. The skin should be covered with some snugly fitting cotton material, such as a white stocking or stockinet. The latter is this material (demonstrating), which looks like knitted shirting, and is made in long tubes so we can cut off any length we want, and it comes in various widths for body, leg, or arm. Never put absorbent cotton next to the skin when putting on a cast. It packs down into little wads with the perspiration and is lumpy and uncomfortable. Outside the stockinet we put two layers of sheet-wadding. This is a material used by dressmakers for lining dresses; it has a little sizing and is slightly resilient. It comes in sheets which are cut up and made into long bandages by the nurse. Over the sheet-wadding we lay a piece of felt wherever there is to be a good deal of pressure or where there are bony prominences. In this case we pad around the malleoli with felt and also put a piece on the dorsum of the foot and under the heel, because the foot must be pulled down while the heel is pushed up so that there may be no tension on the tendo achillis. Over the sheet-wadding and the felt an ordinary roller bandage is put on very snugly and very smoothly, taking pains not to let the edge of the bandage or the reverses make wrinkles which will press into the skin. A cast may become unbearable within twenty-four hours from the extreme pain caused by the constant pressure of a wrinkle in the stockinet or a fold in the bandage. In putting on the plaster bandages put them on smoothly, snugly, and rub the plaster well into the meshes of the cloth as each turn is put around. That will make a light cast stronger than a heavy one which is not rubbed in. When putting a cast on the foot carry the plaster bandages up to the bases of the toes so as to cover the metatarsophalangeal joints. It is very much more comfortable than a cast which only comes up to the big toe-joint. By turning back the ends of the stockinet over the ends of the cast and fastening them with a few turns of the last plaster bandage we give the cast a more finished appearance and prevent the unsightly protrusion of frayed and ragged edges of the padding which soon become soiled. After three days a large fenestrum will be cut out over the incision so that the wound may be inspected and redressed. If there is no infection the second dressing will be left on until the stitches are taken out—about the ninth day. I shall try to show you this patient when the cast is taken off so you may see the result. When the final cast is taken off, in about two months, the patient will be allowed to begin to walk in a shoe which has an extra high heel so as to maintain the position of equinus and hold the heel up.

CLINIC OF DR. VERNON C. DAVID

Presbyterian Hospital

LOCAL ANESTHESIA FOR HEMORRHOIDECTOMY

Summary: Technic of infiltration, extradural and parasacral anesthesia—advantages and disadvantages of each method; removal of hemorrhoids with the clamp and cautery—the after-treatment; results in 150 cases.

This patient, a man thirty-two years of age, has suffered from piles for the past four or five years. The remainder of the history of this case is not of special interest, and the physical examination discloses nothing of importance other than several hemorrhoidal masses in the rectum. I shall confine myself to a discussion of local anesthesia for hemorrhoidectomy, and shall demonstrate the method which has proved most desirable in my hands.

Heinrich Braun describes an "umspritzung" or infiltration anesthesia for rectal operations demanding more or less sphincter dilatation, which is based on the principle of blocking the nerves just before they reach the rectum. This, in my opinion, is the method of choice. The patient is placed in lithotomy or Sims' position, and with a fine needle four wheals are made in the skin about an inch from the anus (Fig. 212, 1). These wheals are connected subcutaneously, using about 20 c.c. of a $\frac{1}{2}$ per cent. novocain solution, to which has been added 1 drop of adrenalin for each 10 c.c. of solution. A long needle, 10 cm. of medium bore, is substituted, and with the left index-finger in the rectum, hooked around the internal sphincter, injections are made into or just outside the sphincters from each wheal in the skin (Fig. 212, 2). A circular area around the rectum is thus injected. To avoid causing pain in these deep injections it is necessary to have the anesthetic medium precede the needle-

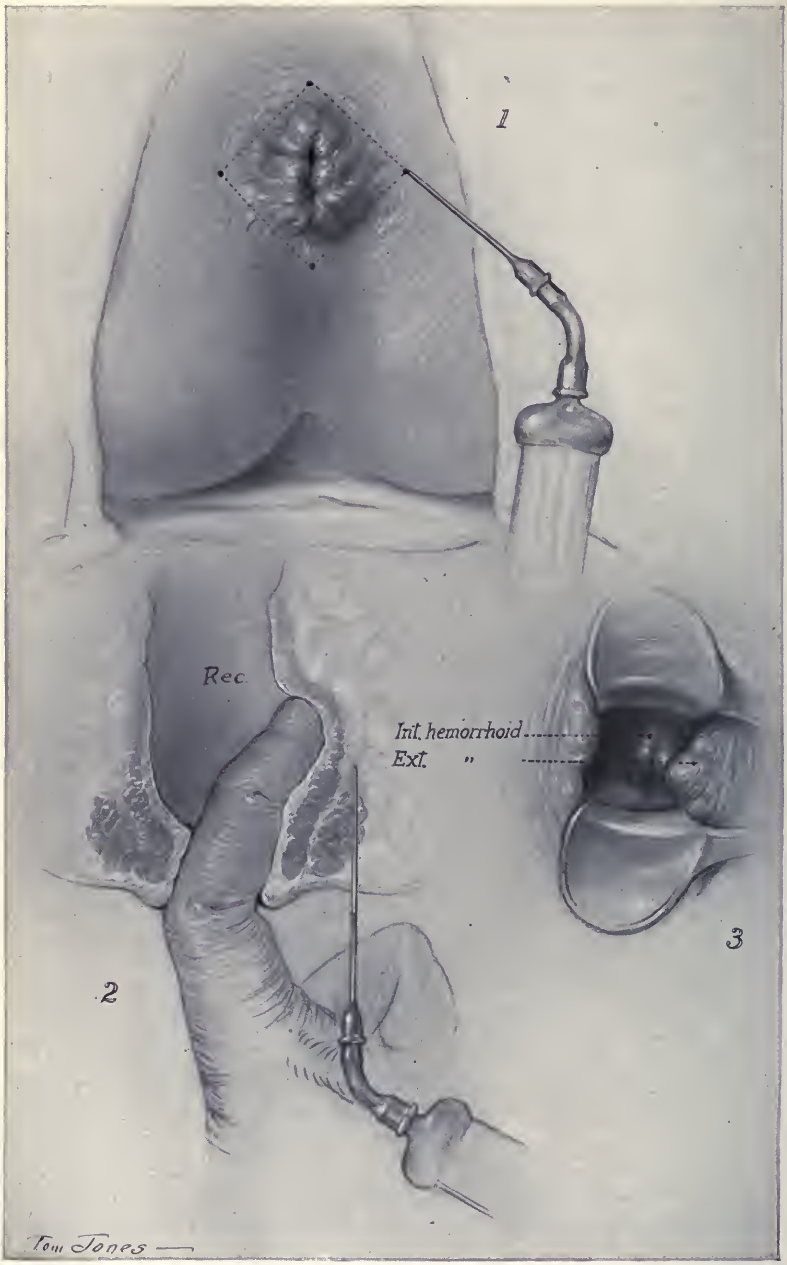

Fig. 212.

point to induce a pressure anesthesia for the minute. From each of these four wheals in the skin 10 to 15 c.c. of anesthetic is injected. In all, 90 to 120 c.c. of $\frac{1}{2}$ per cent. novocain-adrenalin solution is used. The time consumed in this injection is fifteen to twenty minutes. It is best not to infiltrate the tissue to be removed and distort it, but to inject outside of the operative area. Total anesthesia of the lower rectum is present in twenty minutes from the beginning of the injection, and this anesthesia lasts for thirty to sixty minutes.

I believe that this type is the best local anesthetic for the work under consideration, because it always works, the field of operation alone is anesthetized, the technic is simple, and there are no resultant complications.

After the injection of the last quadrant of the sphincter a rectal speculum is introduced and a careful dilatation of the sphincter muscles is made, avoiding a sudden forcible dilatation which might tear their attachments (Fig. 212, 3). A thorough dilatation is one of the principal factors in the prevention of after-pain, especially in cases of long-standing sphincter spasm with consequent hypertrophy.

Our operative procedure consists in removal of all hemorrhoids, taking the most inaccessible first, including skin tags below the hemorrhoids if any be present (Fig. 213, 4). A deep sulcus is cut in the skin to the mucocutaneous junction (Fig. 213, 5) and the hemorrhoid is removed by clamp and cautery, so that the clamp-line and eschar are nearly in the same plane (Fig. 213, 6, 7). The sulcus in the skin is closed by interrupted 00 catgut (Fig. 213, 8). A small gutta-percha strip is left in the anus for twenty-four hours. The after-treatment consists of frequently applied warm boric applications with a tight bandage. Codein, $\frac{1}{2}$ grain by mouth, is given if necessary for the pain. Phenolphthalein and liquid petrolatum is used to insure easy bowel movements, which are induced

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Fig. 212.—*1.* Four cutaneous wheals connected by subcutaneous injection. *2.* Finger hooked around internal sphincter as a guide. Anesthetic introduced into outer substance of sphincter muscles. *3.* Gradual, moderate dilatation of sphincter muscles.

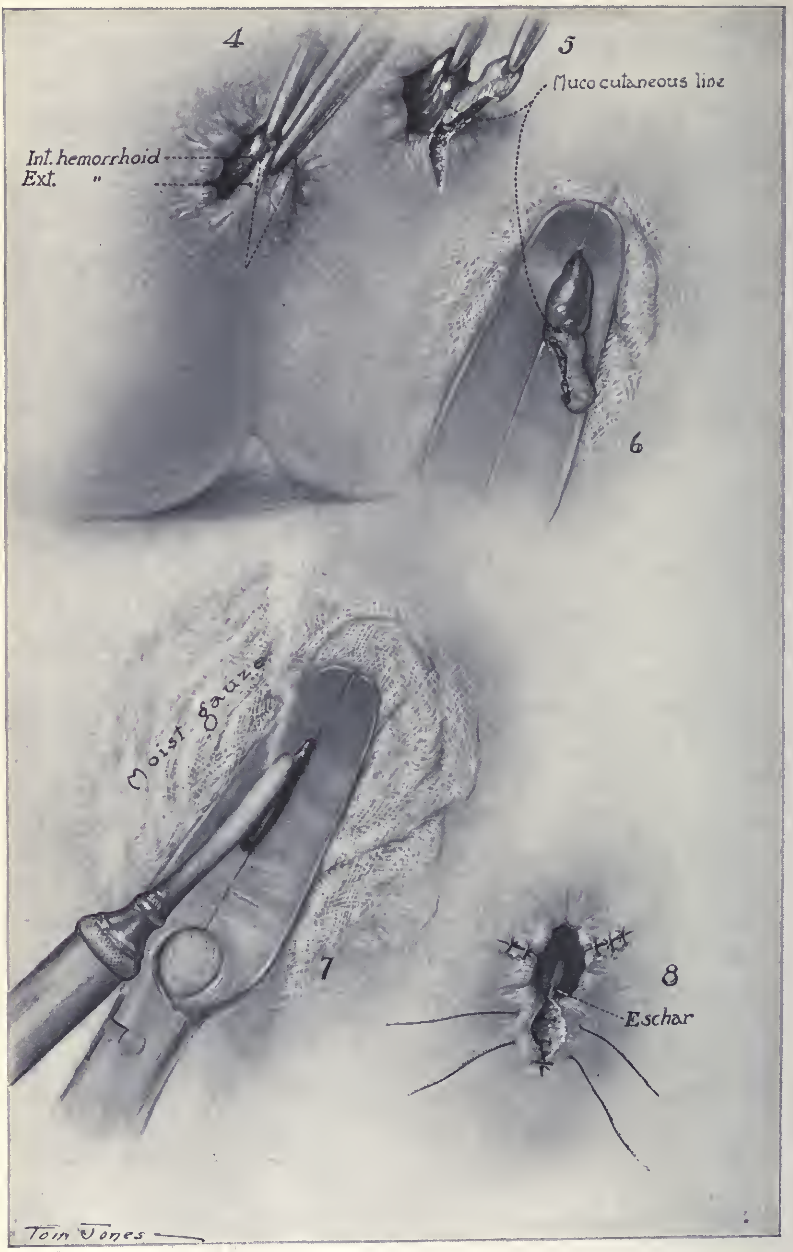
4
5
Mucocutaneous line
Int. hemorrhoid
Ext. "
6
Moist gauze
7
8
Eschar
Tom Jones

Fig. 213.

every twenty-four hours by the injection of 1 ounce of olive oil and 1 pint of warm water through a soft-rubber catheter.

In 150 cases which Dr. Frank E. David and I have operated on by this method the average amount of anesthetic used was 90 c.c. of ½ per cent. novocain solution. The average stay in the hospital was five days after the operation, and over 90 per cent. of the patients were out of the hospital in less than a week. Pain during the administration of the anesthetic was limited to three or four needle pricks which were often unnoticed. Pain during the operation has been absent in most instances. The patients have been quiet, and many of them have dozed from the effects of a preliminary hypodermic of ⅙ grain of morphin. One patient with cystitis had a strong desire to urinate, and 5 had uncomfortable pressure in the rectum during the dilatation of the sphincters. One other patient complained of pain over the sacrum. Omitting these complaints, the sphincters were dilated without discomfort. Pain after the operation usually consisted of burning and smarting for two to three hours. It was classed as slight in all but 18 cases, where it was of moderate severity, and 8 of these patients received codein, ½ grain by mouth, and 3 others received two doses. Complications were practically absent. The skin edges were healed in ten days, as a rule, and suppuration in the wounds was minimal. *There have been no cases of secondary hemorrhage.* Only 2 patients were catheterized for inability to urinate following the operation.

The nerve supply of the anal portion of the rectum is from the pudic nerve, the pelvic branches of the posterior cutaneous fermoral, the sacral and coccygeal plexuses, sympathetic nerves

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Fig. 213.—*4*. Internal hemorrhoid and skin tag below it picked up by forceps (dotted line represents area incised by scissors). *5*. Sharp dissection of skin tag up to mucocutaneous junction above which is internal hemorrhoid. *6*. Skin tag, which has been dissected free, is held up and clamp is applied under it to the internal hemorrhoid. Then the internal hemorrhoid and skin tag are cut off with scissors about 0.5 cm. above the clamp. *7*. Cauterization of internal hemorrhoid close to clamp. *8*. Interrupted catgut suture of defect from removal of skin tags. It must be noted that the sutures are not placed in the oval circumference so as to constrict it, but simply to restore it to normal proportions.

from the pelvic plexus, and to some extent from the nerves passing through the inguinal canal. It is obvious that blocking the pudic nerve would not yield the anesthesia desired. On the other hand, the extent of anesthesia obtained by lumbar intradural injection is out of all proportion to the small field of anesthesia necessary for hemorrhoid operations. Extradural anesthesia and parasacral anesthesia are other types which deserve consideration for rectal work.

EXTRADURAL ANESTHESIA

In 1903 Fernand Cathelin described minutely the sacral canal and a space 6 to 9 cm. long between the second and fifth sacral vertebræ, inferior to the termination of the cord, which he called the epidural space. The upper portion of the sacral canal is occupied by the dural sac, which reaches to the lower border of the second sacral vertebra, and at this point the dura becomes adherent to the periosteum, nearly excluding the dural sac from the epidural space. The lower end of the epidural space lies at the hiatus sacralis, a triangular opening on the dorsum of the sacrum at its junction with the coccyx (Fig. 214). This opening, which is about 2 cm. long and 1 cm. wide, and has at its apex the crista sacralis, is more or less closed by the posterior sacrococcygeal ligament. The intervertebral foramina leading from the epidural space are closed around the nerves by projections from the periosteum to the dural sheaths of the nerves. Anesthetic medium injected into the epidural space comes in contact with the blind end of the dural sac, the filum terminale, the sacral and coccygeal nerves, loose cellular tissue divided by septæ, containing lymphatics, and venous spaces emptying into the vertebral vein. Injections of colored solutions into the epidural space in animals and cadavers by Cathelin,[1] Schlimpett and Schnider,[2] and Laewin[3] showed that the injected solution did not always remain localized, but might be found extradural in higher parts of the canal or even intradural in smaller amounts. For this reason Laewin insists on a low position of the pelvis during the injection of anesthetic into the epidural space. Cathelin originally used 3 c.c. of a 1 per cent. cocain as the anesthetic, but concluded the method was unsatisfactory. Later Stöckel used 30 c.c. of ½ per cent. novocain in obstetric cases and had a resultant lessening of the pain, but not complete anesthesia.

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[1] Cathelin, Paris, Bailliere et fils., 1903.

[2] Münch. med. Wochensch., 1910, Nr., 49.

[3] Zentralbl. f. Gynakol., 1909, Nr., 1.

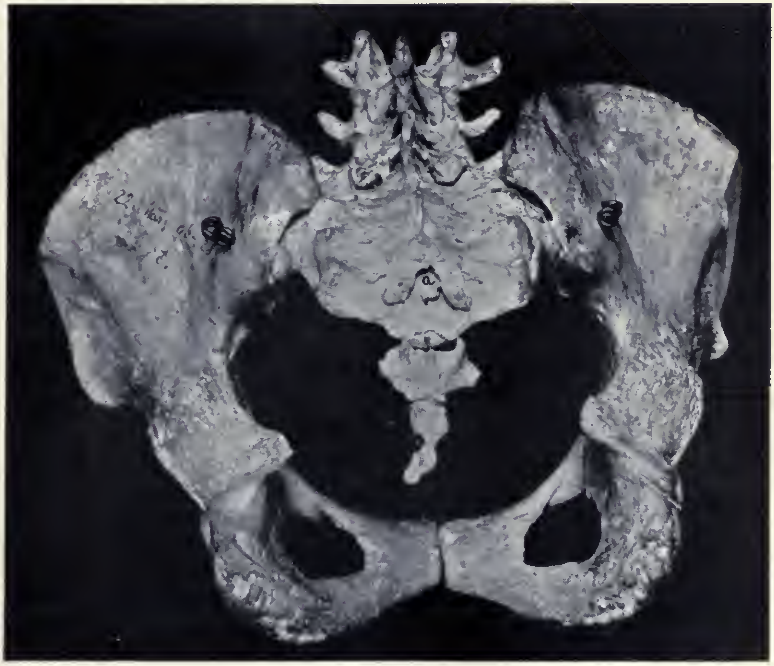

Fig. 214.—The hiatus sacralis (*a*) is seen just above the sacrococcygeal junction.

Laewin then advocated the use of 20 c.c. of 2 per cent. novocain solution made in a sodium chlorid, sodium bicarbonate solution, and obtained anesthesia of the lower rectum, pelvic musculature, penis and scrotum, or vulva and vagina, and often a zone of anesthesia along the posterior aspect of the thigh. The technic of the operation is as follows: The patient is placed in a sitting or semirecumbent position. The base of the hiatus sacralis is palpated about 2 cm. above the midline groove between the buttocks. After making a wheal on the skin a dull needle with a sharp stilet is pushed carefully through the membrane covering the hiatus sacralis, and after the stilet is removed the needle is pushed forward 4 cm., withdrawn a little, and 20 c.c. of a 2 per cent. novocain-adrenalin solution is slowly injected. Laewin insists on a slow injection to guard against rapid absorption and consequent general symptoms. After a wait of twenty minutes anesthesia is complete, and the sphincters may be stretched or operations on the pelvic floor carried out.

As contra-indications are classed adiposity, which prevents finding the hiatus sacralis, arteriosclerosis, and functional or organic nervous diseases. In 80 cases reported by Laewin 7 failed to have perfect anesthesia. Payr reports three failures of anesthesia in 65 cases. Kehr in 140 gynecologic cases found the anesthesia insufficient in 10 per cent. and absent in 8 per cent. As to complications: In Laewin's cases 7 had general symptoms, such as dizziness, oppression, nausea, etc., of transient duration. Schlimpert and Schnider in 365 cases report one instance of sciatic rheumatism and another case had temporary paralysis of the quadriceps extensor following the anesthesia. Stochel reports 1 case of right-sided necrosis of the gluteus muscle after the anesthesia.

The objections to extradural anesthesia are the uncertainty of locating the hiatus sacralis, either due to variable size or to overlying fat, the failure of anesthesia in a small percentage of the cases, and the danger of complications, which though not common, still appear. For rectal anesthesia the method has still further objections, in that an unnecessarily large field of anesthesia is produced.

PARASACRAL ANESTHESIA

Another type of local anesthesia for rectal cases is parasacral anesthesia, which blocks the sacral nerves at their point of exit from the sacral foramina (Fig. 215). Between the second and fifth formina on the anterior surface of the sacrum there is very little concavity to the bone, which makes it possible to push a needle along the anterior surface of the bone to the height of the second sacral foramen. The patient is placed in the lithotomy position. Two points of injection $\frac{1}{2}$ inch from the median line to the right and left of the sacrococcygeal articulation are chosen, and wheals made in the skin. A needle from 9 to 12 cm. long is used. It is inserted parallel to the anterior surface of the sacrum, with the point of the needle seeking the bone until it reaches the bony resistance at the height mentioned, and then the entire distance from the second to the fifth sacral foramen is injected; 20 c.c. of a 1 per cent. novocain-adrenalin solution is used. The needle is now withdrawn a few centimeters and is directed at a small angle anteriorly, always keeping parallel to the median plane. In this direction the needle penetrates deeper than before until it strikes the promontory of the sacrum above the first sacral foramen at a distance of 9 or 10 cm. from the point of entrance, where 20 c.c. more of the solution is injected. A final injection of 5 c.c. is made between the rectum and the coccyx on the same side. The other side of the sacrum is then injected in the same

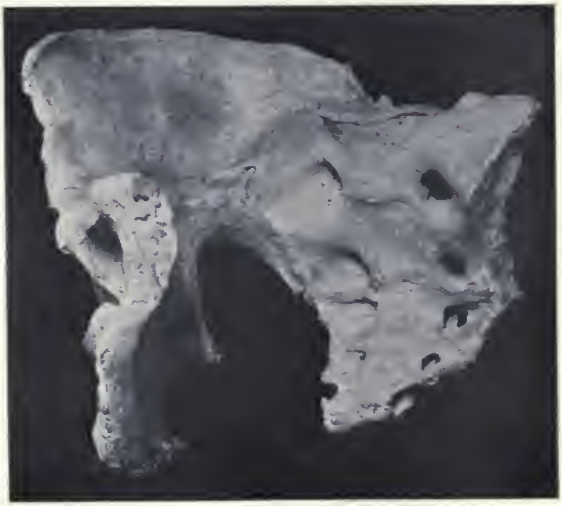

Fig. 215.—Frontolateral view of sacrum, showing the sacral foramina about which the anesthetic is deposited in the induction of parasacral anesthesia.

manner. Altogether, 100 c.c. of a 1 per cent. novocain solution is used. During the injection a finger in the rectum may be used to act as a guide for the insertion of the needle. After a wait of twenty minutes the bladder, prostrate, genitals, and sphincter ani, as well as the skin along the back of the thigh, are anesthetic.

The objections to the method are concerned with the large amount of the anesthetic which is necessary, and the unnecessary extent of the anesthesia produced if it is used for rectal operations only.

My experience leads me to the conclusion that infiltration anesthesia with novocain offers a safe and technically simple method for hemorrhoidectomy or other minor operations on the rectum requiring sphincter dilatation.

An operative procedure, including moderate sphincter dilatation, sharp dissection and suture of cutaneous piles, clamp and cautery of hemorrhoids covered with mucous membrane and no rectal plug, gives a good result with minimum tediousness of convalescence.

CLINIC OF DR. DALLAS B. PHEMISTER

PRESBYTERIAN HOSPITAL

RECONSTRUCTION OF THE HEPATIC DUCT

Summary: A portion of the hepatic duct included in the ligature for the cystic artery during cholecystectomy with resultant complete stasis of bile and destruction of the portion of duct involved; repair by T-tube and omental graft; dangers of cholecystectomy—the control of hemorrhage—causes and results of leakage of bile from cystic duct—frequency of injury to hepatic and common ducts; how the accident occurs; methods of repair.

THIS case illustrates one of the serious complications which occasionally arise from the operation of cholecystectomy.

Mrs. M., age forty-eight, was admitted to service of Dr. B. W. Sippy, Washington Boulevard Hospital, June 23, 1916, with the following history:

The patient had always been fairly well up to fours years ago, since which time she has had about ten attacks of pain in the epigastrium, radiating to the back and right shoulder, severe in character, usually accompanied by vomiting and requiring morphin for relief. The attacks last from one to four hours. The last attack, which was the worst one, occurred one month ago and was followed by soreness and tenderness in the upper abdomen for several days. Never any high fever or jaundice. Between attacks, and particularly during the past five months, the patient has had a great deal of epigastric distress, especially of evenings. Frequently takes soda, which usually gives relief. Has lost 20 pounds in weight during the past six months.

Examination shows a poorly nourished woman, weight 115 pounds, no jaundice. Regional findings negative except for abdomen, which shows tenderness in epigastrium and beneath right costal margin. No tumor mass palpable.

Subsequent observation and study showed absence of evidences of a gastro-intestinal lesion.

Diagnosis.—Cholelithiasis.

Operation, July 6, 1916. Oblique gall-bladder incision extending from the xiphoid downward and to the right to level of umbilicus. Adhesions of omentum and duodenum to a thickened and somewhat contracted gall-bladder, containing several stones and a small quantity of bile. After freeing the adhesions, cholecystectomy was performed, beginning at the cystic duct. The pedicle of the gall-bladder was cut between two clamps. The distal clamp did not include the cystic artery and a sharp hemorrhage resulted. After a little difficulty the bleeding point was clamped and ligated. It was noted at the time that considerable tissue was included in the pedicle, but the bile-ducts were not identified in the mass. The gall-bladder was then removed and the wound closed, with a cigarette-drain left in place. There was more reaction following the operation than is usual, and on the second morning the patient was jaundiced. The jaundice increased rapidly until, on the fifth day, it was very marked and the urine was loaded with bile. The bowel movements became light and watery. The patient became somewhat drowsy and continued to vomit occasionally. Pulse, 72 to 84; temperature, 99° to 100° F. Little drainage and no bile from the drainage-tube.

An obstruction of the bile passage, probably due to the ligature, was diagnosed.

Operation, October 11, 1916. Wound opened. Pedicle of gall-bladder isolated and ligature cut. After its removal it was found that the hepatic duct had been caught in the forceps with the retracted cystic artery, as indicated in Fig. 216, and that a knuckle was included in the ligature. It was difficult to determine the amount of damage to the duct, but from fear of leakage it was opened and a catheter introduced. Following the operation all of the bile came through the tube, the jaundice disappeared, and the stools became clay colored. The tube was removed on the twentieth day, but all of the bile continued to come through the wound. Up to the 15th of August no bile had appeared in the stools. The patient felt well and had gained some in weight and strength. It was decided that the ligated portion of the duct had sloughed and that its continuity, therefore, had been interrupted.

Operation, August 16, 1916, for repair of the hepatic duct. Upon opening the abdomen extensive adhesions were found. A probe was introduced to the bottom of the fistula and the duodenum and stomach dissected from the under surface of the liver, exposing the duct at the seat of injury. The proximal end of the duct was easily identified by the escaping bile, and the end of the distal portion was found by tracing the necrotic bridge which represented all that was left of the constricted portion (Fig. 216, 1). A probe was introduced through the duct to the ampulla of Vater. Before the operation I spent considerable time figuring out a method for repairing the defect. It was decided if possible to pass a catheter through the distal portion 6 or 8 inches into the duodenum, then, after turning back a cuff on the other end, to introduce it into the proximal portion, suturing the divided ends of the duct as well as possible about the catheter. Dr. L. L. McArthur told me that he had used this method successfully in 3 cases, the tubes working out into the bowel in from six to ten weeks. It was impossible to pass a catheter through the ampulla into the duodenum despite the fact that it was armed with a silver wire. I was not surprised at this difficulty, as I had previously tried it without success on 4 fresh cadavers.

The duct was finally repaired with a T-drain, making the two arms that were introduced into the ends of the duct about 1¼ inches long (Fig. 216, 2, 3). The divided portions of the duct were so adherent that they could not be brought together about the tube, leaving a bridge of about ½ inch which was covered over by a loop of omentum carefully tamponed about it and held in position by catgut sutures (Fig. 216, 4). Bile came freely through the tube to the outside, and the first stool on the fourth day was clay colored and gave a negative test for bile. However, the test on the next stool was positive. On the eighth day the outside tube was tied off and all of the bile

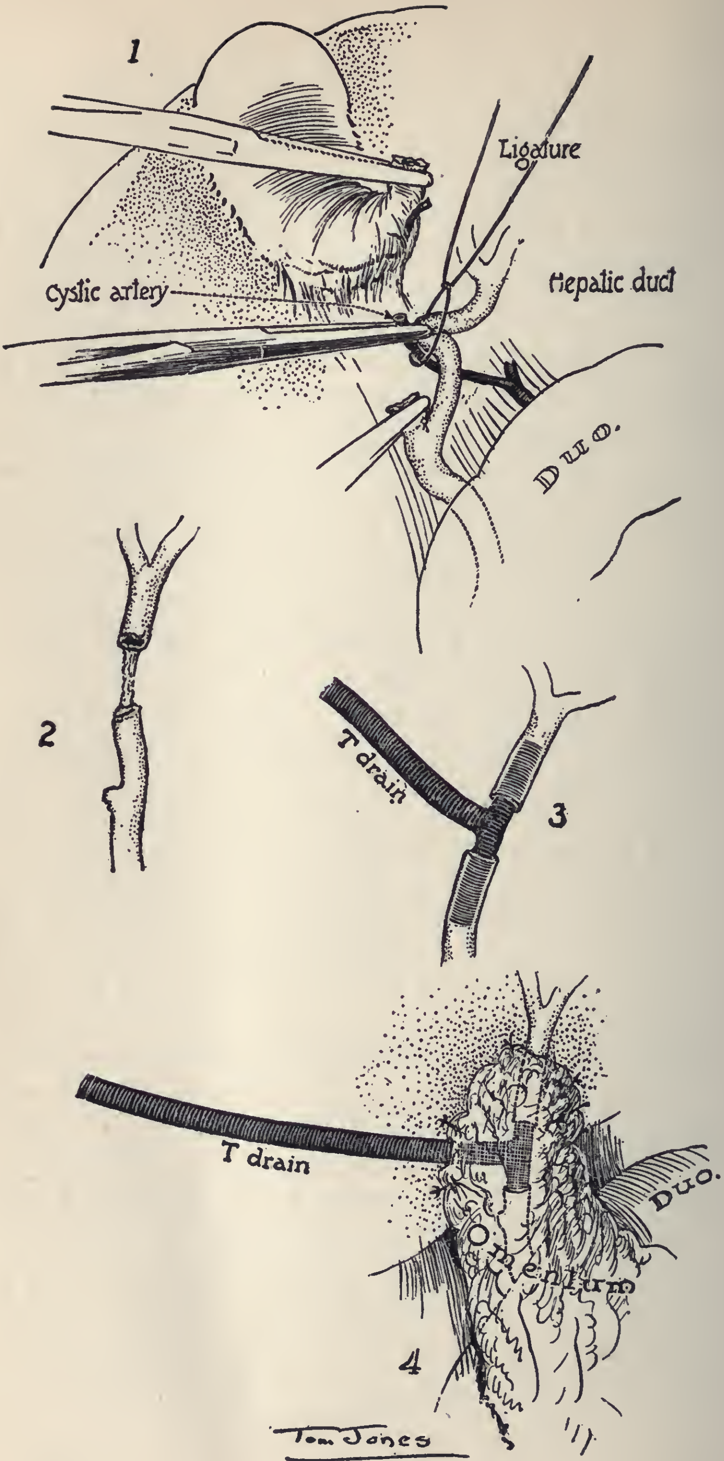
1
Ligature
Hepatic duct
Cystic artery
Duo.
2
T drain
3
T drain
Duo.
Omentum
4
Tom Jones

Fig. 216.

went into the intestine. The tube was left in position for eighty-four days, during which time there was never any leakage about it. The patient gained rapidly in strength and weight and became free from symptoms.

November 8, 1916, under gas anesthesia, the tube was pulled out. There was some leakage of bile for eight or ten hours, when it closed and has remained closed since.

The patient continued well until two weeks ago—January 15, 1917—when, while suffering from the grip, she had some abdominal pain, a chill, and temperature of 104° F. These symptoms rapidly disappeared, but were followed by slight jaundice and bile in urine, which have now disappeared. It is too soon to judge of the significance of this occurrence, but it may mean that a stricture is developing at the seat of the repair. I will report subsequently upon the outcome.

The main reason for preferring cholecystostomy to cholecystectomy is the greater difficulty and risk encountered in performing the latter operation. If it were as easy for the surgeon and as safe for the patient no doubt nearly all calculous gall-bladders would be excised, as re-formation of stone is prevented and an infected organ which may not be rendered healthy by simple drainage is removed. The important dangers from cholecystectomy are hemorrhage, leakage of bile from the cut end of the cystic duct, and injury of the common or hepatic ducts. Hemorrhage usually comes from the cut cystic artery, and in case the exposure is poor it may be extremely difficult to control. Considerable bleeding may occur from the gall-bladder, but this is more accessible, and since it is chiefly a venous oozing can be stopped by a gauze-pack in case the bleeding points cannot be tied off. Rarely the right branch of the hepatic artery is injured, and instances are reported where it has been tied off without subsequent clinical evidence of injury to the liver.

Fig. 216.—*1*. Hepatic duct accidentally included in the bite of the forceps—and later in the ligature—which caught the retracted, bleeding cystic artery. *2*. Remnants of necrotic segment found at last operation. *3*. **T**-tube in place. Because of adhesions, the ends of the duct could not be brought together about the tube. *4*. Omentum sutured about the defect.

Early leakage of bile from the stump of the cystic duct comes either from failure to include it in the ligature of the pedicle, which sometimes results when the artery forceps slips and the stump has to be caught again, or from injury to the duct by the artery forceps, particularly when it is forcibly pulled upon during ligation. I have seen an instance of each during the past year. It results in a profuse discharge of bile from the drainage-tube within a few hours. The intestines and omentum rapidly wall off the general peritoneal cavity and a biliary ascites usually does not form, but bile goes into the space between the under surface of the diaphragm and the liver, as it is much more difficult to wall off. In one instance there was very severe pain in the right chest, neck, and abdomen, and a temperature of 101° F. for two or three days resembling a diaphragmatic pleurisy. This was the result of a mild infection of the biliary accumulation. Fortunately, this early leakage of bile is rarely dangerous, as the bile is usually sterile or nearly so and peritonitis very rarely results. I have had one death from infection of such a subphrenic accumulation of bile which leaked out alongside a drain placed in the common duct. The patient was seventy-six years old and deeply jaundiced from a common duct stone at the time of operation. At autopsy ten days later bile was found in the general peritoneal cavity and only a moderate amount about the gall-bladder region. The right subphrenic space contained about 1 quart of bile mixed with pus, and there was extensive fibrinous exudation on its walls. Early leakage of bile from infected ducts is, of course, much more dangerous. The leakage which occurs not infrequently from sloughing of the ligated stump of the cystic duct two or three to fifteen days after operation is of little danger because the tract is well walled off by that time.

Injury of the hepatic or common duct is no doubt much commoner than is realized. Kehr states that in his first 1000 cholecystectomies there are records of injury of the hepatic duct in one form or another in 16 cases. Because of the meager reports in the literature he inquires if it be possible that he is the only offender. When the removal of the gall-bladder is begun at the fundus, as was Kehr's practice, the injury to the hepatic duct results from cutting during isolation of the pedicle or from clamping and cutting beyond the drawn-up junction of the cystic and hepatic ducts.

Injury of these ducts should occur less often when the cholecystectomy is begun at the cystic duct, as the pedicle can be isolated and the vessels clamped, thereby avoiding the bleeding which obscures the field of operation. When the cystic artery is not properly caught or takes an aberrant course the likelihood of injury in controlling the hemorrhage still exists, as in my case. However, I find no instance in the literature where the duct was injured by this particular method of inclusion of a knuckle in the ligature with subsequent sloughing. In the reported cases the common duct has been injured oftener than the hepatic. In case the injury leads to a persistent biliary fistula various operative procedures are employed for its correction to meet the exigencies of the case. They are extensively reviewed by Kausch[1] and recently by Ginsburg and Speese.[2] The latter attempted the repair of the duct by the use of a T-tube without the surrounding covering of omentum, but there was sloughing and leakage about the end in the duodenal portion. The T-tube was removed and the duct repaired by the use of a fascial transplant over a rubber tube, which was still *in situ* at the time of the report four months after the operation. I believe that the method here employed will be the one of choice where a tube cannot be passed into the duodenum and the duct ends sutured over it. End-to-end anastomosis without a tube has been used where the repair has been made immediately following the injury, but it is difficult to perform and will nearly always be found impossible in secondary operations because of the adhesions that have formed. Lewis and Davis successfully repaired severed common ducts in dogs by use of free transplants, but these had a tendency to stricture formation. The same objection can be made to the omentum as used in this case. That a considerable length of the duct can be suc-

[1] Archives für Klin. Chir., vol. xcvii, p. 249.

[2] Annals of Surgery, vol. lxv, p. 65.

cessfully replaced by omentum is illustrated by a case in which Brewer could not find the distal end, and used a rubber tube surrounded by a canal of omentum to connect the proximal end with an opening in the anterior surface of the duodenum. The tube was subsequently passed and the patient was well one year after operation.

Anastomosis of the proximal end of the duct with the duodenum, which has proved successful in a few cases, would have been a technical impossibility in my case, because the end of the duct was retracted and buried in a mass of adhesions. A new duct has been made from a flap of duodenum or a loop of jejunum after the method of Kausch. These methods have been little used, and it is questionable if better results will be obtained from them than from the employment of omentum or fascia.

CLINIC OF DR. CARL B. DAVIS

PRESBYTERIAN HOSPITAL

A CASE OF PANCREATIC ABSCESS: RESULT ONE YEAR AFTER OPERATION

Summary: History suggestive of gall-tract disease, but differing from the classical picture sufficiently to preclude a positive diagnosis; discovery and drainage of abscess of the pancreas at operation; digestion of tissues about the incision by the discharge and resultant ventral hernia; differentiation from acute metastatic pancreatitis; probability that a perforated duodenal ulcer was the source of the infection.

THIS patient, a physician forty-five years of age, entered the hospital about one year ago because of a gradually increasing distress in the upper abdomen. One month before admission there was observed a vague discomfort after meals, accompanied by an irregular tympany. Cathartics and enemata had but little influence on his condition. Pain gradually developed in two regions, first on the right side, in the location of the gall-bladder, and, second, beneath the left costal arch. The pain was more severe after meals. The pain was referred occasionally to the right lumbar region, but never to the scapula. The pain was not a severe cutting colic, but rather a dull, grinding ache. The patient in describing it said it felt as though he were filled with rolling rough stones. Morphin was required finally to control the pain.

There was no nausea or vomiting during the illness. The stools were clay colored for a time and then returned to normal. The feces were examined for gall-stones, but none were found. On one occasion previous to admission to the hospital several whitish stones were passed, but no analysis of them was made and their origin was not determined. The previous health had been good—no similar attacks before. Typhoid fever eighteen years ago. No venereal history.

Examination showed a well-developed, muscular man. There was no jaundice. Eyes reacted normally to light and accommodation. The pupils were equal. Mouth, throat, and neck were negative. The lungs and heart were normal. The abdomen was normal in appearance, slightly rotund. Palpation showed marked tenderness and moderate rigidity over the gall-bladder region. There was a point of lesser sensitiveness under the left costal arch. The liver margin was palpable. Beneath the liver margin was an area of resistance with no definite outline. The spleen was not palpable. There was no ascites. The lower abdomen was normal. The genitalia and extremities were negative. There was no lymphadenopathy. The reflexes were normal throughout. The temperature was normal each morning, with an evening rise to 101° F. Pulse was about 100 and respirations 24. Stomach analyses were negative. Feces normal in color, urobilin present. Weber negative. No mucus, pus, or undigested food particles. There is no record of examination for starch or fat. The urine was normal. A twenty-four-hour specimen showed 2000 c.c. Blood examination: erythrocytes, 4,680,000; leukocytes, 28,000; hemoglobin, 70 per cent.; Wasserman reaction negative.

On the basis of the transient occurrence of clay-colored stools and the passage of stones per rectum; of the location of the maximum pain in the right hypochondrium and the marked tenderness and moderate muscular rigidity in the same region; of high leukocyte count and the septic temperature, a probable diagnosis of empyema of the gall-bladder was made and operation advised.

On opening the abdomen under a general anesthetic the gall-bladder and passages were found normal. A finger in the foramen of Winslow came in contact with a firm, rounded mass in the pancreas. Beneath the transverse colon a mass was seen bulging downward and forward against the transverse mesocolon. This protrusion was ruptured and 6 to 8 ounces of pus escaped as the finger passed into the body of the pancreas. A cigarette-drain and a soft-rubber tube were passed into the mass, the peritoneal rent was closed as thoroughly as possible, and the omentum was packed and sutured against the opening and along the course of the tubes. The dressings were changed at frequent intervals, but there developed nevertheless a rather marked destruction of the abdominal wall. Two weeks after operation the discharge ceased and the tubes were withdrawn. The patient eventually left the hospital with a ventral hernia.

The source of the pancreatic infection is not clear. An acute metastatic pancreatitis passing into a suppurating condition would have a different clinical picture. There should have been more acute colic earlier in the history, associated, as a rule, with nausea and vomiting. The possibility of a gastric or duodenal ulcer perforating upon the pancreas must be considered. The patient had been a hearty eater, and up to one month before entering the hospital there had been no distress associated with the taking of food. Of course this does not rule out the possibility of ulcer, because the literature is full of cases reporting perforated duodenal ulcer with no previous symptoms. Of gastric or duodenal ulcer, it seems that the latter is more probable because, as the finger entered the lesser peritoneal cavity through the foramen of Winslow, there was no break in the peritoneal lining of the bursa, the cavity was empty, and the abscess of the pancreas was confined by the posterior layer of the peritoneum. The stomach showed no induration, and there was no adhesion of the stomach to the pancreas. The clay-colored stools were due probably to a temporary closure of the bile-duct by pancreatic pressure. The passing of the light-colored stones might suggest a blocking of the pancreatic ducts by calculi, with a gradual onset of suppuration, but the rapid convalescence following operation does not support such a contention.

With the opening of the abscess cavity we were fearful of the occurrence of fat necrosis and pancreatitis. Fortunately there was no leakage into the peritoneal cavity. There was considerable digestion of the abdominal wall by the escaping pancreatic juice with the discharge of necrotic connective tissue, but the wound healed readily after the removal of the drainage-tubes.

One year after operation we find this patient at work and in good health, his only complaint being the ventral hernia, for which we have to blame the digestive juices which found their way to the surface by way of the drainage tract.

CLINIC OF DR. N. M. PERCY

Augustana Hospital

RESECTION OF STOMACH FOR CARCINOMA

Summary: History and physical examination of the patient; late appearance of symptoms in carcinoma of the stomach; relationship between gastric ulcer and cancer; gastro-enterostomy in ulcer as a prophylactic against cancer; importance of an early diagnosis; exploratory laparotomy demanded in every case of suspected carcinoma of stomach; technic of resection of the stomach; postoperative treatment; prognosis relatively favorable as to immediate results; symptoms of recurrence probable within two years.

The patient, a male aged fifty-eight years, was admitted to the service of Dr. Percy, February 2, 1917, because of pains in the stomach and some loss of weight.

His family history is negative to carcinoma and tuberculosis. For many years he has had occasional spells of belching, but this is the only symptom he has had referable to his stomach. He had influenza one year ago which was complicated by an infection of the left frontal sinus.

Eight weeks ago he felt some slight rolling pains beneath the left costal margin. He was examined carefully and no trouble found. Seven weeks ago these pains became more annoying and have continued to the present time. They are not severe, have no relation to the taking of food, and for the past two weeks have been present constantly night and day. They are not severe enough to keep him awake, but when he awakens he notes that the pains are still present. Sometimes the pains run down into the abdomen and then back up into the stomach region. Three weeks ago, after eating an orange, he felt nauseated and vomited once. Vomited again after an ordinary supper a week ago. He vomited only a small amount each time and no blood. Stools have always been costive, but there has never been any evidence of blood in them.

He has been on a liquid diet for the past three weeks, but has done this because the *x*-ray plates taken three weeks ago showed a small outlet in the stomach and he is afraid that if he eats coarse things this opening will become plugged. His appetite is good, however, and he has partaken freely of a general liquid diet with no distress after eating. His only weight loss is 8 pounds, which has taken place since being on a liquid diet.

Examination.—The patient is a poorly nourished man with a slightly sallow complexion, but who does not appear fifty-eight years old. Head, eyes, nose, and mouth are negative. There are some small palpable posterior cervical glands, but no axillary or supraclavicular glands. There are no areas of dulness in the lungs, but occasional scattered mucous râles are heard over the left upper lobe. Heart is negative. The stomach is much distended and distinct peristaltic waves are visible. The greater curvature is 2 inches below the umbilicus. Distinct waves come up to a palpable mass 2½ inches to the right of the midline and 2 inches below the costal margin. This mass is 2½ inches across and extends to the right and then downward. It is hard and quite movable, but not tender. The right external inguinal ring admits one finger and the internal ring the finger-tip. Rectal examination shows the prostate slightly enlarged, smooth, and firm. No nodules are palpable in or about the rectal wall. Knee-jerks are present.

x-Ray examination shows the stomach enlarged. Peristalsis normal. At the pylorus there is a large filling defect involving nearly the entire pyloric end of the stomach. The pyloric opening is at the upper portion and is apparently about the size of a No. 10 catheter. The duodenal cap is not demonstrable.

Comments.—Dr. Percy (February 3, 1917): You notice in the history of this case the absence of any and all symptoms until eight weeks ago. With the exception of some rumbling in his stomach he has had his usual normal health with no loss of weight until three weeks ago. Up to the present time there has been no pain in relation to taking of food, his only distress being that described as a rolling sensation in the stomach. You notice he said the rolling sensation first appeared about eight weeks ago. While it is unusual to meet with a case with such absolute freedom from gastric symptoms, still there are many cases of cancer of the stomach which do not produce many definite symptoms until the obstructive signs develop, and, unfortunately, the obstructive signs often do not come on until very late, when the diagnosis has little value.

The relationship between gastric ulcer and gastric cancer is still an unsettled question. The frequency with which gastric cancer develops from a previous benign ulcer has been variously estimated by different observers, the percentage ranging from 3 to 100 per cent. While it may be difficult to demonstrate that a proved case of cancer of the stomach had ever existed as a benign ulcer, there is much clinical evidence to support such a theory. Smithies, in reviewing a large series of pathologically proved cases of cancer of the stomach, found that over 65 per cent. of these cases had a long dyspeptic period of the ulcer type preceding any symptoms which could clinically be interpreted as malignant. The average duration of the clinically non-malignant dyspeptic period of "ulcer type" in this 65 per cent., comprising over 600 cases, later evidencing malignancy, was 10.8 years.

From our experience it would seem that if a careful history is always taken, especially if this is done by the surgeon himself, an even larger percentage of cancer cases will give clinical evidence of the existence of a benign ulcer preceding the malignant growth.

In all cases presenting a clinical history of chronic gastric ulcer the possibility of such ulcer becoming malignant should always be borne in mind. In such cases if relief is not obtained in a reasonable time after careful medical management, surgery should be resorted to, if for no other reason than to lessen the likelihood of the ulcer becoming malignant. The operative procedure in chronic callous ulcers of the stomach is preferably excision of the ulcer or pylorectomy. If such a procedure does not seem wise, then a gastro-enterostomy should be performed, as it has been shown by various observers that malignancy seldom supervenes after gastro-enterostomy. This is probably due to the fact that not only are the mechanics of the stomach changed, but after a gastro-enterostomy the physiology of the stomach is also altered in many ways.

Carcinoma of the stomach is very common. It constitutes practically one-third of all carcinomata of the body. The carcinoma in this case is located in the pyloric end of the stomach, where, fortunately, about 70 per cent. of them are found. I say fortunately, because when in this location the diagnosis is more likely to be made at an early date, and on account of the obstructive symptoms the patients come into the hands of the surgeon at a time when there is a chance of obtaining relief. Furthermore, when the growth is in the pyloric end of the stomach a radical excision is accomplished with greater ease and less risk than when in the cardiac portion.

The most important point in connection with carcinoma of the stomach is an early diagnosis. We look upon cancer of the stomach as being as much a surgical condition as cancer in any other portion of the body. The prognosis in cancer of the stomach compares very favorably with that of cancer of the breast. While every physician advises operation in cases of carcinoma of the breast, there are many physicians who are not very prone to recommend operation to their patients with cancer of the stomach. I think we can promise about as many five-year cures in carcinoma of the stomach if the radical excision is done early as we can in cancer of the breast. Of course the immediate mortality from a resection of the stomach is somewhat higher than that following an excision of the breast, but still, as far as the ultimate results are concerned, they compare very favorably with each other. In every case in which carcinoma of the stomach is suspected an exploratory laparotomy should be made because, just as with cancer in other portions of the body, it is the early cases that offer the most favorable prognosis. When a cancer of the stomach can be definitely diagnosed clinically the hope of a radical cure is not great.

Now, notwithstanding the fact that an *x*-ray examination after the bismuth meal indicated that the pylorus is almost completely obstructed, this patient has had very little vomiting.

I think he has vomited only twice during his illness. Also it is rather peculiar with this amount of obstruction that this man has no stasis. His stomach empties itself, but does that on account of the hyperperistalsis. You note in the history that the food passes out of the stomach in a reasonable time. This patient has lost only 8 pounds in weight. The tumor here is very easily palpable and quite movable. I think you can all see this mass from the benches; still we look upon this case as very favorable for operation.

A distinctly palpable tumor is not at all a contraindication to operate, even though it be a large mass. Some of the cases with the largest palpable tumors are the most favorable cases for operation, while, on the other hand, some of the cases with only small tumors of the stomach may involve the pancreas and, of course, be inoperable. We have found, however, that involvement of the lymph-glands is not necessarily a contraindication to the operation. The lymph-glands, especially in the lesser curvature of the stomach, are usually involved, but they can be taken out at the time of operation just the same as we take out the axillary glands in carcinoma of the breast. Even when the carcinoma is adherent to the pancreas, but the pancreas itself is not distinctly involved, the case may still be operable. In such cases one can take away the tumor without any apparent harm to the pancreas, so as time goes on we are operating more and more of these cases and find that our results justify the procedure.

So far in this case we have not been able to demonstrate metastases anywhere, and we hope when we expose the abdominal cavity that we will not find metastases in the liver. If we do, then we will do only the palliative operation of gastro-enterostomy. Just at the present time we seldom do the two-stage operation in carcinoma of the stomach. I think, however, there are a few cases where it is advisable. On the other hand, I think the majority of cases do better if the operation is all done at one time. In cases with fairly good health the mortality in the two-stage operation is not much different from the mortality in the one-stage operation.

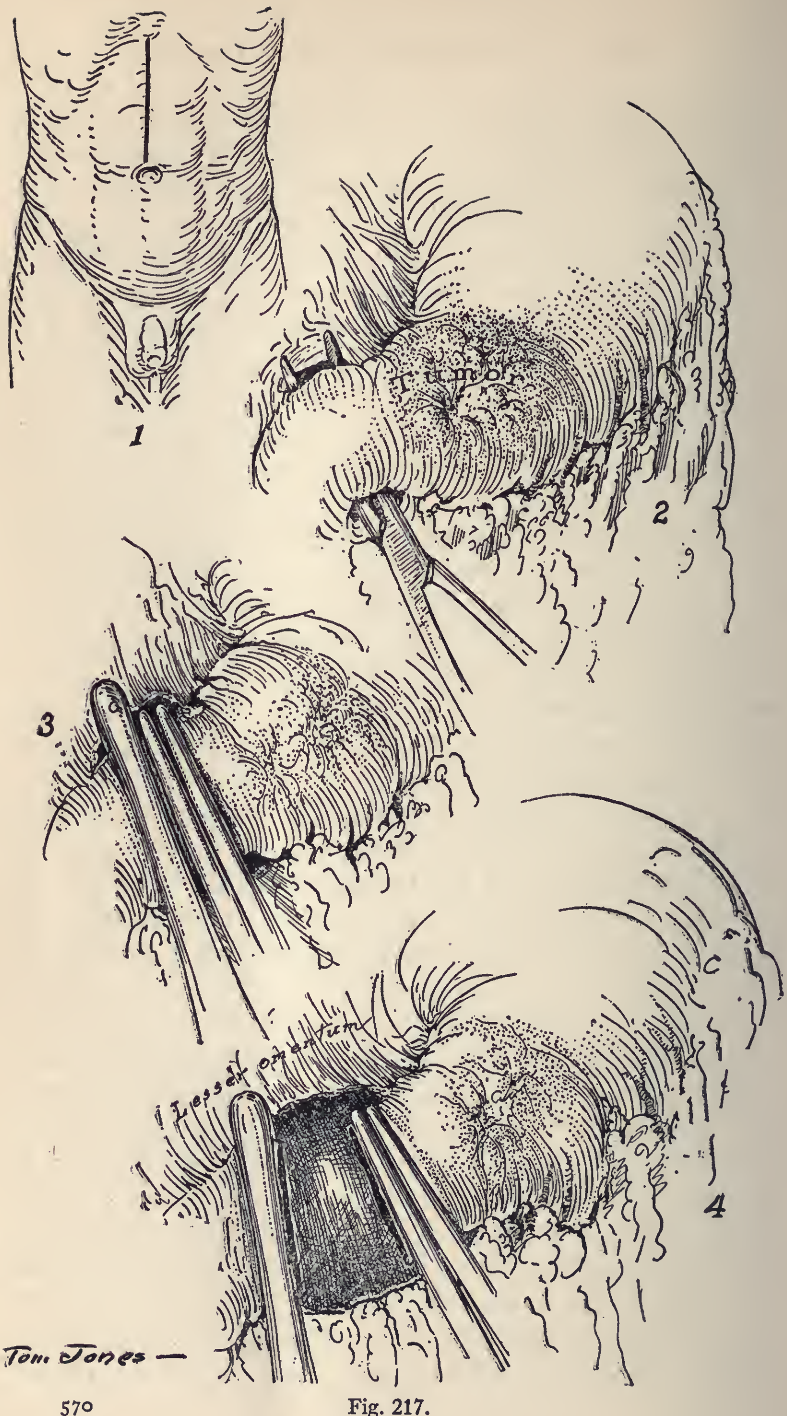

Fig. 217.

Operation.—We will make a midline incision here (Fig. 217, *1*), because we expect to remove at least three-fourths of the stomach, which will take us far over to the left side. I will make the incision from the ensiform cartilage to the umbilicus, keeping in the midline and splitting the linea alba. By so doing we will have practically no bleeding. We split the linea alba and pick up the peritoneum. Now you can all see the large tumor which was felt before operation (Fig. 217, *2*). The tumor is in the pyloric end of the stomach, about 3 inches in length and 2 inches in width. From palpation it would seem that the pylorus is almost completely obstructed. We will now examine the other abdominal organs, especially the liver. I find no enlarged glands underneath the liver nor any masses in the liver. We will examine the pelvis for metastases; there are none. Now I am feeling the prostate. The gland is a little enlarged and somewhat nodular. Now I am palpating the appendix region. I find the appendix slightly adherent, but otherwise negative. The gall-bladder is large, with a defect at the upper portion, making somewhat of a goose-neck appearance. I find no stones in the gall-bladder nor in the cystic duct. You will note in the mesentery of the colon a very small lymphatic gland. However, it does not feel like carcinoma. Enlarged lymphatic glands in these cases do not necessarily mean carcinoma, but are very apt to be inflammatory. Along the lesser curvature of the stomach we find some larger glands. Here is one quite hard, which, in all probability is a carcinomatous gland. That, however, is not a contraindication to operation, as we will remove all the glands in the lesser omentum. The splenic area is negative. The fundus of the stomach is negative. You will notice that the stomach is greatly distended with gas.

We will make our resection by first cutting off the duodenum. With a pair of forceps I tease a way beneath the duodenum through the lesser omentum (Fig. 217, *2*). I have now worked my way along the duodenum 2 cm. and will grasp it with a pair of crushing forceps. You see I am staying about $1\frac{1}{2}$ inches distal

Fig. 217.—*1*, **Site and extent of incision;** *2*, *3*, **and** *4*, **method of mobilizing stomach on duodenal side of tumor.**

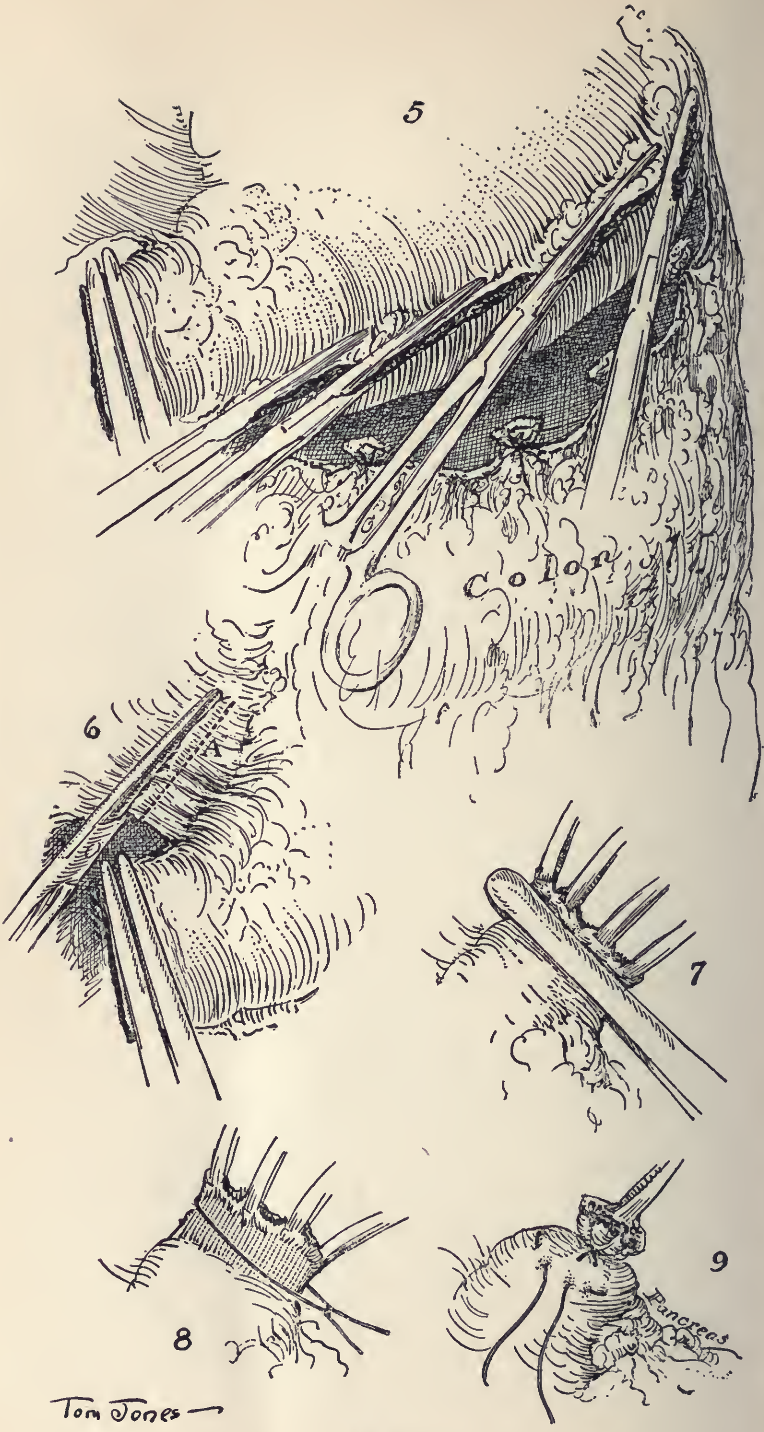

Fig. 218.

to the carcinoma which is right at the pylorus (Fig. 217, *3*). Now we will place two pairs of Ochsner forceps on the stomach side and sever the duodenum between the forceps (Fig. 217, *3*, *4*). We will clamp and ligate the gastrocolic omentum, dividing the gastro-epiploic artery at this point. Now we work along the greater curvature of the stomach, clamping with two pairs of forceps and cutting between, being careful to avoid the colic artery. Now we will ligate the vessels in the gastrocolic omentum before going any further (Fig. 218, *5*). All the vessels in the gastrocolic omentum having been ligated, we replace the transverse colon in the abdominal cavity. Now we come over to the lesser omentum and take this off rather high and close to the liver, removing the greater portion of the lesser omentum, together with all the lymphatic glands (Fig. 218, *6*). At this point the pylorus is grasped and cut and ligated. The dissection is now carried along as far as the point where the gastric artery comes on to the stomach (Fig. 219, *10*, *B*). I cannot feel any glands beyond the point where I have ligated the lesser omentum. As we attempt to raise up the pyloric end of the stomach the pancreas is found to be strongly adherent to the tumor, and also a loop of jejunum is adherent at this junction of the adhesion of the tumor and pancreas. I will first cut the jejunum from the tumor, leaving the peritoneal portion of the jejunum attached to the growth, and then sew over the defect of the intestine thus caused with a few Lembert silk sutures. In separating the tumor from the pancreas it is necessary to trim away a small portion of the pancreas with the growth. The resulting defect in the pancreas will be covered over by the stump of the ligated gastrocolic omentum. The tumor is now free from the pancreas. The gastrocolic and lesser omentum having been ligated, a large crushing clamp is placed across the stomach at the level of the point where the gastric artery comes on to the stomach. Another clamp is placed on the stomach just distal to the crushing clamp

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Fig. 218.—*5*, *6*, Freeing greater and lesser curvature from omental attachments. Hemorrhage controlled by means of clamps and ligatures; *7*, *8*, *9*, method of handling duodenal stump by ligation in groove left by crushing clamp and invagination with purse-string suture.

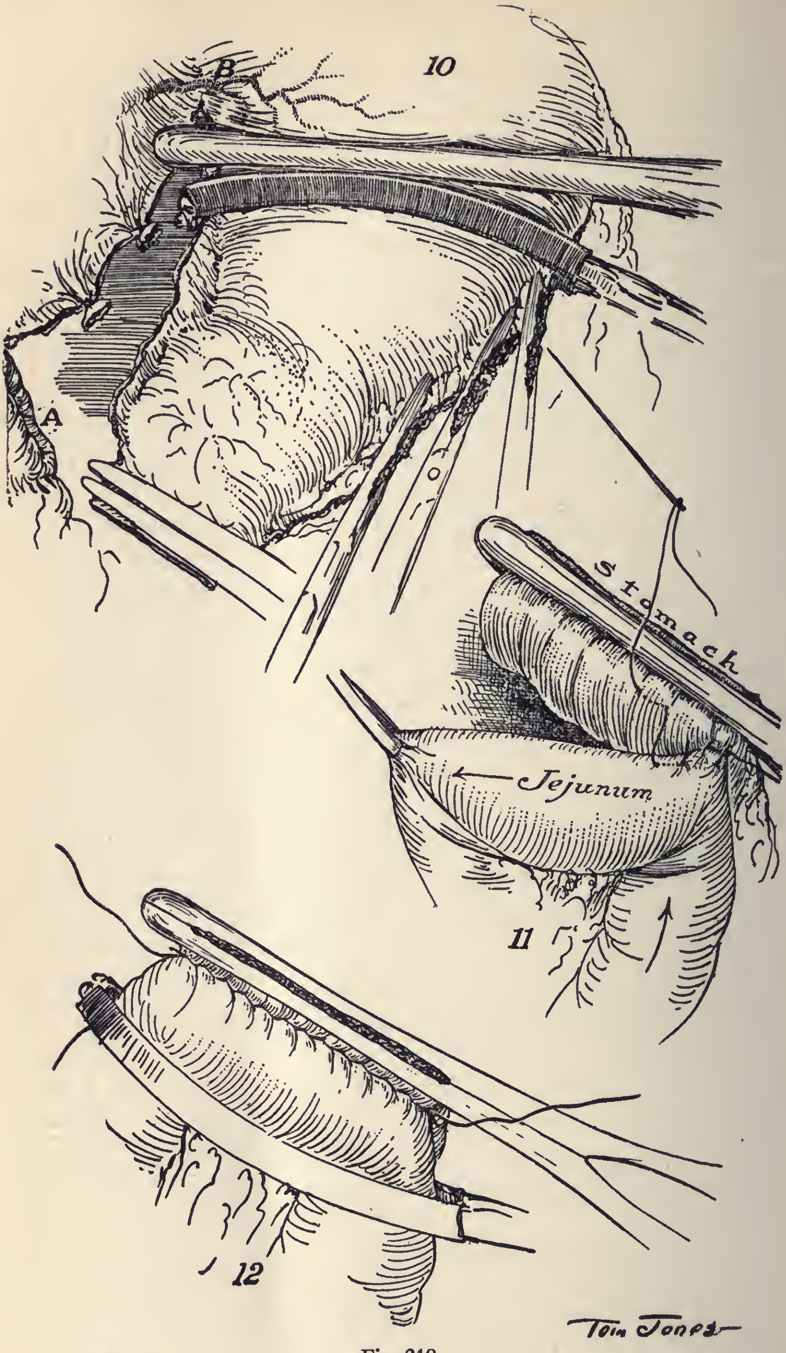

Fig. 219.

to prevent leakage from the resected portion of the stomach, and the stomach is severed just distal to the crushing clamp. This removes the tumor, pylorus, about three-fourths of the stomach, together with the lymphatic glands in the lesser omentum and the gastrocolic omentum. The open end of the duodenum is now disposed of by placing four mouse-toothed forceps on the end of the duodenum, then removing the crushing clamp and ligating with catgut in the groove made by the clamp (Fig. 218, *7*, *8*). This ligature controls the hemorrhage from the duodenum. A purse-string of silk is placed in the head of the duodenum and the ligated end of the duodenum inverted, just as one inverts the stump of the appendix (Fig. 218, *9*). Three or four interrupted Lembert silk sutures are placed in the end of the duodenum to make sure that there can be no leak.

Having disposed of the duodenum, our next step will be to re-establish the continuity of the stomach and intestine. Recently, instead of closing the open portion of the stomach and making a gastro-enterostomy, we have been anastomosing the jejunum directly to the open end of the stomach. That is what we will do in this case. The transverse colon is held up, making its mesentery taut, and an area comparatively free from blood-vessels is selected and a large hole torn in the mesentery. A loop of jejunum is pulled up through this opening in the mesentery of the colon, after which the colon is returned to the abdominal cavity, thus avoiding any unnecessary exposure of the intestine. The portion of the jejunum for the anastomosis is selected as high as possible without having any tension on its proximal portion after the anastomosis is completed. With the crushing clamp still on the stomach, the jejunum is attached along the posterior edge of the stomach by means of a running Lembert silk suture (Fig. 219, *11*, *12*). A Roosevelt clamp is now placed, grasping the end of the stomach and the jejunum, the crushing clamp is removed, and several mouse-toothed forceps applied to

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Fig. 219.—*10*, Tumor-bearing tissues isolated. Their ablation will be completed by an incision which will be carried through the stomach between the two uppermost clamps. *11*, *12*, The first (posterior) row of stitches which approximate the serous surfaces of stomach and jejunum.

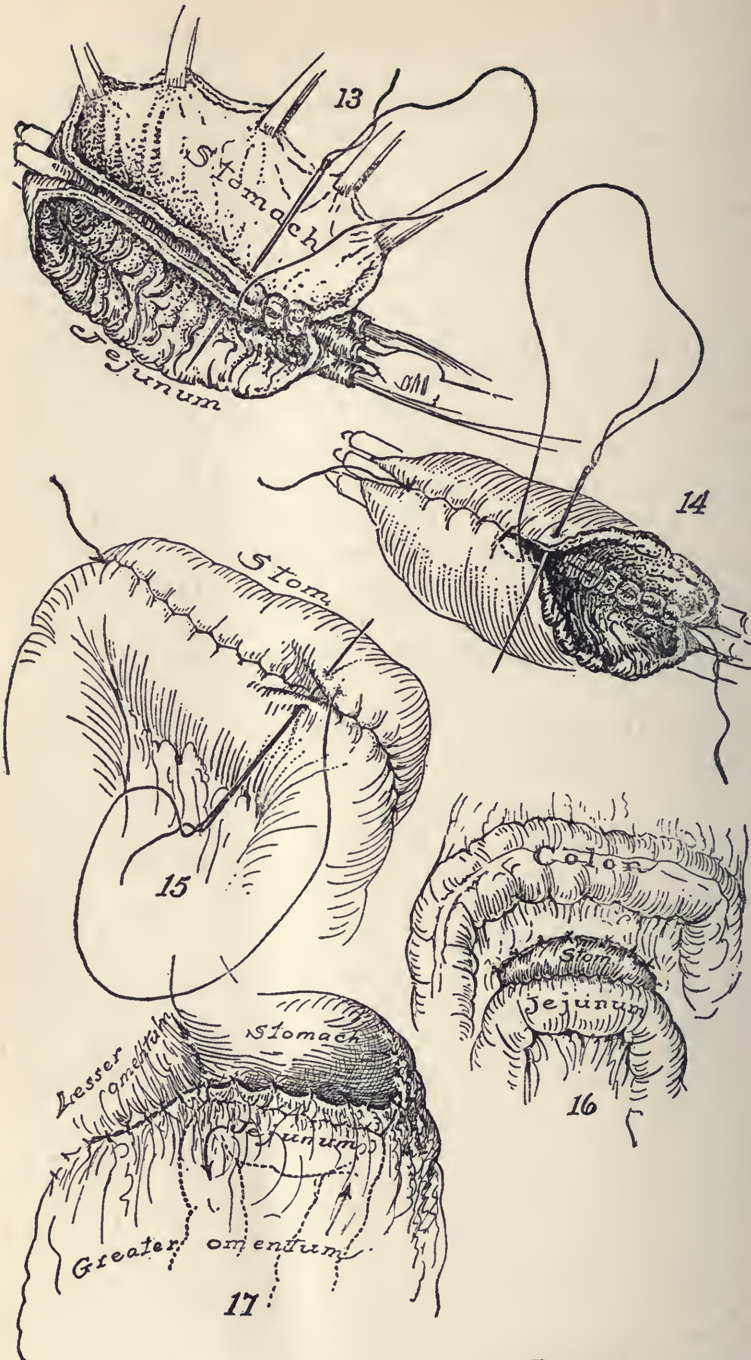
13
Stomach
Jejunum
14
Stom.
15
Colon
Stom.
Jejunum
16
Stomach
Lesser omentum
Jejunum
Greater omentum
17
Tom Jones

Fig. 220.

the edge of the anterior wall of the stomach (Fig. 220, *13*). The jejunum is opened, making the incision parallel to and about ¼ inch from the Lembert suture line to the posterior wall of the stomach. A second row of continuous sutures, using chromic catgut, is placed, passing through all the coats of the stomach and jejunum (Fig. 220, *13*), placing the sutures close enough together to be certain that all the hemorrhage is controlled. After completing this second row of sutures posteriorly it is changed from an over-and-over stitch to a running Connell suture and continued around anteriorly, uniting the anterior edge of the stomach with the jejunum. This suture controls the bleeding and at the same time folds in the edge of the mucous membrane of the stomach and intestine (Fig. 220, *14*). The anastomosis clamp is now removed from the stomach and jejunum and a Lembert silk suture (Fig. 220, *15*) is carried around anteriorly, thus completing the anastomosis. The transverse colon is now brought up and the anastomosis pulled down through the opening in the transverse colon, and the edges of this opening carefully sutured to the stomach wall about ½ inch from the anastomosis suture line (Fig. 220, *16*).

Drainage.—Ordinarily, following resection of the stomach, it is our custom to close the abdomen without drainage. In this patient, on account of damage done to the pancreas by cutting the tumor away from this organ, a cigarette-drain will be placed down to the head of the pancreas and brought out through a stab-wound. If there is any leak of pancreatic fluid it will be taken care of by the drain.

Postoperative Treatment.—The patient will be placed in bed in a semisitting posture, which will favor immediate drainage

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Fig. 220.—*13*, Beginning the through-and-through hemostatic stitch, which is carried as such the entire length of the posterior half of the incision, but is changed to a Connell in-out-and-over stitch (*14*) when the anterior half of the incision is reached; *15*, completing the closure of the anastomosis by means of a continuous Lembert stitch; *16*, edge of hole in mesocolon has been stitched to the stomach about 1 cm. proximal to the line of anastomosis. Note the colon drawn upward. *17*, Colon has been dropped back into place and the space left by the removal of the tumor has been obliterated by stitching the edge of the incision in the great omentum to the stomach and to the lesser omentum.

from the stomach. Normal salt solution will be administered per rectum by the Murphy drop method, giving 500 c. c. every four to six hours. Sips of water will be given by mouth this afternoon if there is no nausea. If there is any vomiting, a gastric lavage will be given and repeated as often as is necessary. It is seldom necessary, however, to use gastric lavage, as there is usually no vomiting and very little nausea. It is our experience that following a partial gastrectomy the patients have less nausea and vomiting than the average abdominal case. Beginning the third morning after operation a daily S. S. enema is given, but no food until the fourth day, when liquids in small quantities are allowed. The salt solution per rectum is discontinued on the third day. A cathartic will be administered on the tenth day, after which a soft diet will be allowed. The patient will be kept in bed a period of two weeks.

Prognosis.—The mortality in a case of this type is about 10 per cent. The chances of an ultimate cure are slight. In all probability, I would say that this patient will do well for one and a half or two years and then have a recurrence of the disease. Occasionally a case of this type remains well for several years.

CLINIC OF DR. JAMES T. CASE

St. Luke's Hospital

COMPARISON OF THE OPERATIVE AND RADIOTHERAPEUTIC TREATMENT OF UTERINE MYOMAS

Summary: Essential similarity of the penetrating and therapeutic properties of the hard roentgen rays and the gamma-rays of radium; radiotherapy successful in a certain class of uterine fibroids; mortality and morbidity due to operative treatment as contrasted with that following radiotherapy; conclusions—operation recommended in all but cases of uncomplicated fibroids; rapidly growing tumors, pregnancy, serious disease of the adnexa and failure to obtain complete preliminary curetage with microscopic examination of the curetage, contraindicate *x*-ray or radium treatment.

It is within the memory of many practising physicians that the treatment of fibroids by means of electrical currents aroused a lively hope that this non-operative method would make it unnecessary to send a patient to the surgical ward for relief from uterine fibroids, but after a very brief existence this hope had to be abandoned.

Again a new non-surgical treatment for uterine fibroids has arisen in the application of roentgen rays and radium, and the practicability of this method seems to be established beyond question in a certain class of cases. The testimony of numerous authors, including such men as Bordier, Albers-Schoenberg, Fraenkel, Pfahler, Schmidt, Béclère, Kroenig, Gauss, Krause, Lange, Abbe, Kelly, and Burnam, as well as my own experience, shows beyond controversy that uterine fibroids can be dissipated by radiotherapy, including both roentgen and radium treatment.

As I have urged elsewhere, there is no great difference between the effects of the gamma-rays of radium and the hard roentgen rays, which are almost exclusively used in deep therapy. Modern roentgen treatment of deep-seated areas is so conducted that the filtered rays which reach the deeper parts are only those of high penetration, equalling that of most of the gamma-rays of radium. As a matter of fact, Russ has shown that, while the wave-length of the most penetrating gamma-ray is appreciably shorter than that of the hardest roentgen rays, the waves of some of the gamma-rays are longer. The hardest gamma-rays extend only about one octave higher than the hardest roentgen rays now available. Indeed, Rutherford's recent work indicates that the gamma-rays of radium may be regarded as secondary roentgen rays produced in the radium; Russ further declares that the hard roentgen rays, such as we are using daily, have such a high penetration, that the intensity of a beam is only reduced to 10 per cent. by going through 12 or 13 cm. of tissue. Add to the foregoing a realization of the fact that roentgen tubes are capable of furnishing thousands of times the amount of radiant energy obtainable from, say, 100 mg. of radium element, and we begin to appreciate that there is probably not so very much practical difference between these two agents.

The gamma-rays of radium are subject to the same physical laws which govern roentgen irradiation. The law of the inverse square of the distance applies just as truly in radium work. It is not enough to know the amount of filtration and the number of milligram-hours of application; the distance from radiant source to part must also be carefully noted, for only thus may the time of application be governed. The technic of radium application is as yet in many respects as primitive as was the roentgen method sixteen or eighteen years ago. The quantity of hard rays furnished by a roentgen apparatus is certainly very considerably larger than that of gamma-rays from a powerful radio-active substance; and it is possible, therefore, in spite of the lesser penetration of roentgen rays, to achieve a high degree of intensity even through thick filters. Radium has many advantages peculiar to itself, especially that of being applicable within cavities and tumors, thus producing rays directly within the tumor, and offsetting considerably the disadvantage of requiring a much longer time of application. Anyone fortunate enough to have both agencies at his command will utilize both in combination whenever possible.

Histologically there is no difference, according to Wickham and many others, in the changes produced by radium and the roentgen rays. Von Seuffert declares that radium, mesothorium, and roentgen rays are of about equal value in radiotherapy, all having their limitations in pathologic processes that are too extensive. Pusey has not been able to see any difference whatever so far as clinical effects are concerned. The radio-epidermatitis described by Ragaud and Nogier as occurring after the administration of very high doses of extremely hard roentgen rays is quite analogous to the skin reaction which may follow the application of highly filtered gamma-rays.

That radiotherapy, always referring by this term both to radium and the roentgen rays, is successful in a large class of myoma cases in causing amenorrhea and in reducing the size of the tumor in many cases, is conceded by practically all gynecologists. It has now been practised long enough and in a sufficient number of different clinics to permit of a satisfactory classification as to diagnosis and results.

Mohr gives statistics in 796 consecutive myoma cases, in 56 per cent. of which the hemorrhages were overcome, amenorrhea being produced. These cases have been classified as cured. In 380 cases the size of the tumor was noted, with the following results: unaltered in 21 per cent.; reduced in size in 57 per cent.; marked reduction in size in 13 per cent.; entire disappearance of tumor in about 5 per cent. In 5 cases the tumor actually increased in size.

Kelly has reported relief from hemorrhage and either shrinkage of the tumor or its complete disappearance under radium treatment in all types of myomas. The time required varied from two months to one and one-half years after treatment was begun. Under both radium and roentgenotherapy shrinkage of the tumor continued long after treatment was suspended. It would seem that the most reasonable method of treatment would be a combination of roentgen and radium therapy.

Contenting ourselves with the foregoing brief statements, we will assume the general acceptance of the fact that radiotherapy is a successful means of therapy employing the roentgen rays, radium, or both, in a certain class of uterine fibroids, a condition for which surgical operation was heretofore the only treatment to afford radical relief. What, then, are the relative merits of the operative and the radiotherapeutic methods in the treatment of this condition?

No deaths can be justly attributed to roentgenotherapy. Certainly very few which have occurred can in any way be attributed to radium therapy, and there is little necessity for any future fatal results from roentgen treatment, now that the technic has been worked out with a considerable degree of satisfaction. We may, therefore, conclude that there is no immediate risk to life with either roentgen or radium treatment.

The operative risk is variable, depending upon the operator. We have reports of so large a series as 150 consecutive cases without any deaths, or, as another authority puts it, 157 cases with only 1 death. But probably the average death-rate in the hands of the average surgeon will vary between 2 and 3 per cent. The occurrence of a fatal case due to mesenteric vascular thrombosis, pulmonary embolism, or some other unlooked for tragic event in operative treatment tends to turn the scale of judgment, at least temporarily, in favor of the radiotherapeutic method. The immediate operative risk, however, is more than offset by the frequency with which necrosis or malignant degeneration occurs. This will be discussed later.

In a general way it may be said that the fatalities following operation are encountered in the surgery of difficult, complicated cases. In uncomplicated cases the simple operation gives a very low mortality—under 1 per cent.

Under roentgen or radium therapy there is none of the shock which may attend the operative treatment of myoma. Neither is there any scar unless one is so unfortunate as to cause the patient a roentgen dermatitis of serious grade. Nevertheless, the scar following operation is of no particular moment, and in the present state of surgical technic the occurrence of shock is becoming less and less frequent. True, there is a certain amount of nausea, vomiting, and weakness for a number of days after the operation, but all these drawbacks are very much mitigated if the patient has the benefit of careful postoperative management.

For that matter, roentgen and radium therapy have also been attended by considerable physical distress, the so-called "roentgen kater" which has been described and studied by numerous roentgenologists and radiumtherapists. Many theories as to the causation of this phenomenon have been advanced, and various methods of mitigating its unpleasant symptoms have been practised. The "roentgen kater" consists of a general, undefinable, unpleasant feeling accompanied by headache, palpitation, tired feeling, nervousness, and sometimes pain. It has even been suggested that some substance produced as the result of radiation is incorporated into the circulation causing a sort of toxemia, as the result of which the above symptoms are manifested. No one has yet satisfactorily explained the exact cause of this kater, whether it is due to some secretion or product liberated through the effect of the rays, or whether there is an absorption of the rays, pure and simple. These symptoms last from six to sixty hours, usually about twenty-four hours. They do not occur in all patients. Some patients are only slightly affected, while in a few cases the condition is grave. Sometimes negative symptoms are observed, by which are understood manifestations of a neurotic character which had not existed previously in the presence of the hemorrhage. The foregoing symptoms, if they occur at all, may be noted to a certain degree after a single treatment, but usually are more pronounced after a series of treatments.

Taking into account the fact that each series of treatments for fibroids ordinarily extends over two to four days, and that the patient receives from two to four or five series of treatments, if not more, it is easily possible that during the months covered by the radiotherapeutic measures the patient may have to suffer physically, to a greater or less degree, for a number of days totaling more than she would have suffered in connection with an operation. Following a laparotomy for fibroid the patient spends from two to sixteen days in bed, and is probably incapacitated for the ordinary pursuits of life for another ten to fourteen days. In connection with radiotherapy some patients suffer no inconvenience whatever, while most of them suffer a little, and perhaps one-third of the total number suffer serious inconvenience for a period practically equivalent to the number of days of incapacitation following a laparotomy. Formerly, when larger quantities of radium were used the pain attending the treatment was often very distressing. The present tendency is to employ smaller quantities of radium, say 30 to 50 mg., with adequate filtration, beginning with exposures of a few hours each, at intervals of from one to several days, until five or six exposures have been made. An interval of three or four weeks' rest is allowed to elapse, followed by a second but shorter exposure, and in some cases after an interval of two or three weeks, with a third series of applications. This amount of radium therapy is especially likely to be successful if the roentgen method is employed in conjunction with it. As stated above, while some patients do not suffer any inconvenience, others have been observed to suffer a certain amount of actual pain during the first radium application, still more pain during the second radium séance, and a very considerable amount of pain during the third séance. The pain may become so severe that patients may beg, and frequently do beg, to have the radium removed long before the alloted time has expired. The amount of pain complained of was more pronounced when large quantities of radium were used than with our present plan, where 50 mg. is the maximum quantity employed.

I have also observed that a narrowing of the vagina developed in some cases after radium therapy. The occurrence of this narrowing has been very definitely noted, and in at least 1 case has seriously interfered with later treatment per vaginam. Kelen, of the First University Clinic for Women in Budapest, reported 200 cases of gynecologic disease treated by means of radiotherapy. In all his cases there was narrowing of the vagina during the course of the treatment. This untoward effect probably occurs more often than has been reported.

Following operations one may observe the development of such untoward effects as hernia, intestinal adhesions, nervous unrest, septic peritonitis, phlebitis, ileus, and wounds of the ureters. But the fact should not be lost sight of that with radiotherapy it is also possible to encounter untoward late effects, such as pathologic changes in the blood, damage to the skin, and colitis, quite irrespective of the question whether the tumor has or has not been cured.

An effect upon the skin occurs in about 1 case out of 8. This effect is usually slight, often a mere browning of the skin, but once in a while a severe dermatitis occurs even in the best regulated clinics, partially due, no doubt, to the fact that there is a definite idiosyncrasy to the roentgen rays. McKee, of New York, and several other authorities whose words deserve every consideration, doubt whether such a thing exists as a special sensitiveness to roentgen rays, but from experience I am convinced that such a thing is occasionally encountered. This need not be a serious deterrent, for one can easily make it a rule to give at the first séance a dose of roentgen rays sufficiently small to provide against any possible idiosyncrasy.

Albers-Schoenberg, who was probably the first to apply the roentgen ray in gynecology, has always laid stress upon the necessity of avoiding the intestines in the course of radiotherapy. So far as roentgen rays are concerned, this may be effected with tolerable certainty in uterine exposures by applying the lower brim of the cylinder diaphragm of the tube holder just above the symphysis pubis, and tilting it toward the head sufficiently to allow the axis of the rays to run obliquely into the true pelvis from above downward, as in roentgenography of the urinary bladder. By means of a louffa sponge it is also possible to secure compression, which serves to displace the intestine upward.

Nevertheless the patients sometimes suffer from diarrhea, and at least in one case the continuation of the treatment was made impossible on account of this symptom. Rectal tenesmus is sometimes a very troublesome symptom. Vesicular tenesmus may occasionally be observed, more pronounced in some patients than in others. but it only lasts for a few hours after the application of the rays, and so far as I can learn permanent manifestations of this kind have never been observed.

Late damages to the skin have unquestionably occurred. Gauss claims never to have seen any serious harm to the skin when using the 3 mm. filter of aluminum, but he personally demonstrated to me at least one case of skin damage. This may have occurred after writing the statement, later published, that he had never seen any burns. In my own clinic I have seen one case of late injury to the skin where the skin damage did not appear until nine months after the last treatment, but it should be remarked that in the early months of treatment in this case the filtration was only leather and 1 mm. of aluminum. The injured area finally developed an ulceration which persisted for years, eventually becoming malignant.

Desplate reports a case of myoma treated during ten months. In the course of the seventh month an infiltration of the abdominal skin was noticed which assumed the nature of an ulcer by the end of the tenth month; 3 mm. of aluminum filter were used in this case.

D'Halluin reports 2 cases treated during seven months, two treatments per month, using 2 to 3½ mm. of aluminum as filter, dosage 2.8 Bordier units. Seven months after the last treatment an infiltration appeared which later changed into ulcer.

Bordier has observed at least 3 cases in which injuries were first noticeable six to twelve months after the termination of the roentgen treatment.

Speder described 3 cases of myoma where, six or seven months after treatment, deep reaction set in attended by marked pain and requiring six to seven months to heal. It may be mentioned that in practically all these cases of late skin injury an occasional slight erythema has been allowed to occur during the application of the rays.

Bevan has personally communicated to me a case in which about a year after the last application of roentgenotherapy for myoma a roentgen ulceration appeared on the skin of the suprapubic region, which later took on malignant characteristics.

Bumm, of Berlin, has stated repeatedly that the vaginal surface is very much more tolerant of roentgen rays than the abdominal skin. Nevertheless, my own experience agrees with that of Romminger, who observed that vaginal erythema may appear somewhat later than the surface lesions, but in an intensified form.

Taking into consideration all the available data, we must admit that it is possible for late and even very late injuries to manifest themselves in the areas that have been exposed to the rays, even though great care has been exercised in the applications.

Is the tumor cured by radiotherapy? Immelman stated in 1912 that he could only speak of 50 per cent. of cures in myoma patients; he had rarely seen complete involution of the myoma. Mohr reported cures in 56.2 per cent. of 796 cases. Johannes reported 83 per cent. of cures in a series of 1395 myoma cases. The operative cure is practically 100 per cent. The percentage of radiotherapeutic cure naturally depends in large measure on the efficiency of the radiologist. Pfahler was probably the American pioneer in deep roentgenotherapy and one of the first to treat myoma with the roentgen ray. His results have been very encouraging. He lays special emphasis upon the necessity that the cases should be carefully selected by gynecologists, but treated by an expert radiotherapist. In a paper read before the Clinical Congress of Surgeons in 1916 I emphasized the fact that the same principles which must be so carefully observed in roentgenotherapy also apply in radium therapy, and I would take this occasion to reiterate its importance in view of the fact that but few gynecologists or general surgeons seem to understand the principles upon which the measurement of dosage in radiotherapy is based.

Kelly has been very enthusiastic over the results of his radium therapy in myoma cases, and hopes to cause the disappearance of the tumor in 90 per cent. of the cases without serious discomfort or risk. Abbe, of New York, agrees with Kelly that radium treatment is ideal in certain cases of uterine fibroids, but he does not recommend the treatment in cases of pedunculated tumors.

Reference has above been made to the fact that in many cases of operation for myoma the patient has constipation following operation. In a paper before the Michigan State Medical Society in August, 1916, I raised the question as to the advisibility of utilizing the pelvic colon to peritonize raw surfaces following such pelvic operations as hysterectomy. That this procedure is reasonable to a certain degree admits, in my opinion, of no doubt, but I also feel that many cases of postoperative constipation are due to postoperative adhesions of the pelvic colon which has been placed in an unfavorable situation. Conditions are quite different with roentgenized patients, for although myoma sufferers frequently complain of obstinate constipation, this often disappears after roentgen treatment.

In operated as well as in roentgenized patients there usually occurs an increase in body weight and an increase in hemoglobin.

In my own experience, at first employing roentgenotherapy alone, but later in combination with radium therapy, I have observed in about one-half of the cases a distinct diminution in the size of the tumor which can be determined upon external palpation. In half of the remaining cases there is a less distinct retrogression in the size of the tumor, as determined by bimanual examination. In the remaining quarter of the cases no change could be noticed in the size of the tumor except that in at least 2 cases the tumor definitely increased in size in spite of the roentgen treatment. The following is an example of the very striking result which is sometimes obtained: A very large tumor, reaching two or three fingerbreaths above the navel, was so reduced within eighteen months that its presence could only be determined by bimanual examination, the uterus being approximately twice the normal size. It was interesting to note that the retrogression in this case continued gradually even after the discontinuance of the treatment, which terminated with the fifth series of applications of roentgenotherapy, one series a month. It is not at all uncommon in comparing notes with other men having a large amount of material at their disposal to learn of cases where a tumor which originally filled the true pelvis was finally reduced to the size of a goose egg. The tumors

I reported as unchanged had occurred mostly in older women and had existed for a long time without appreciable change in size. The fact that retrogression in the size of myoma continues in many cases long after the cessation of treatment does not mean at all that such a manifestation must necessarily be due to a prolonged after-effect of the roentgen rays. It may be due to a state of complete cessation of ovarian function.

The difficulty of making a correct diagnosis of uncomplicated intramural myoma constitutes one of the chief drawbacks to the radiotherapeutic management of uterine fibroids. The chief of one of the largest surgical clinics in this country recently stated to me in conversation that gross errors in abdominal diagnosis occurred in about 16 per cent. of the cases which came to operation. Many of the unsuccessful cases in roentgen and radium therapy are based upon incorrect diagnoses. The percentage of incorrect diagnoses will be diminished if we follow the advice of Pfahler, who very properly urges that the cases for treatment must be selected by gynecologists, but he insists they must be treated by roentgenologists. A pseudomucous cyst, adherent to the right side of the uterus, may be mistaken for uterine fibroid. A large cyst of the ovary may be found adherent to the uterus, which also contains myomata. Such a patient might be treated for a long time, even with disappearance of the myomata, and still remain uncured. In another instance a supposed myoma proved to be a spindle-cell sarcoma of the right ovary. Submucous or pedunculated myomata are not good subjects for radiotherapy. Calcified fibroid tumors, of course, can never be reduced except by operation. The chief danger in ray treatment lies in the fact that the absolute diagnosis of uncomplicated fibroids is frequently very difficult, and there is a great chance of overlooking malignancy or associated inflammation of the uterine appendages or of the appendix vermiformis. Uterine and ovarian degeneration are very common in the presence of fibroids.

Tracy[1] found in a series of 3561 operative cases of uterine fibroids 1189 cases of associated diseases, including degenerative changes in the tumors, lesions of the appendages, and even malignancy, in all of which it was impossible to hope for cure from roentgen or radium therapy alone. This amounted to exactly one-third of the cases. In 501 cases, or approximately 14 per cent., the degeneration and changes in the tumors and uterus and in the appendages were such that the lives of the patients would sooner or later surely have been sacrificed had they been treated only by radiotherapy. In addition to these 501 cases there were 405 patients with ovarian cysts and abscesses of the broad ligaments, tubo-ovarian abscesses, pyosalpinx, and ectopic gestation, in none of which could the roentgen rays have possibly cured the troubles, and in practically all of which failure to attend to the lesions would have resulted in the loss of the patient's life. Tracy's figures constitute a very serious arraignment of radiotherapeutic treatment of fibroids, to which it is very difficult to find a satisfactory answer.

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[1] Penn. Med. Jour., vol. xviii, p 353.

Early malignancies constitute a very decided drawback to radiotherapy in myomata. Various statistics have been furnished as to the frequency of malignant degeneration and sarcomata. Klein, of Munich, is authority for the statement that 7.7 per cent. of all myomata exhibit malignant degeneration. Franque calls attention to the fact that sarcomatous degeneration is found in 3 to 6 per cent. of his cases. Winter found sarcomatous degeneration in 2 per cent. of the subserous, 4 per cent. of the interstitial, and 9 per cent. of the submucous myomata. In Franque's cases a preoperative diagnosis of malignancy could only be made in 6 cases of sarcoma out of 13.

Olow, of the University of Lund, Sweden, found that 5.2 per cent. of the operative uterine myoma cases were complicated with malignancy. A very significant fact is that the presence of cancer had not been diagnosed in any of these cases before operation and had been suspected in one only. On account of the ease with which amenorrhea is produced in women past the age of forty it is common for advocates of the radiotherapeutic method to urge the ray treatment of fibroid tumors of the uterus in women past that age. However, Tracy investigated the age at which degeneration takes place in myoma, and found that 90 per cent. of the malignant degeneration takes place in women past the age of forty.

Certain writers claim that no observations have been reported in which malignancy developed in the uterus after it had been treated for myoma with the *x*-ray or radium. Shoemaker reported the case of a patient who was given radiotherapy for uterine myoma over a period of two years. Five years later hemorrhages reappeared. Abdominal hysterectomy was advised and performed. The tissue removed was reported by the pathologist to be a fibroid tumor undergoing malignant degeneration. I personally know of a case where a large fibroid myoma of the uterus, reaching well above the navel, was treated four years ago with both roentgen and radium therapy, and is now the seat of a definite carcinoma. Doubtless other similar cases have been recorded. On the other hand, Montgomery,[1] of Philadelphia, has recently reported in his clinic 3 cases where carcinoma developed in the stump of the uterus several years (in 1 case nine years) after supravaginal hysterectomy for myoma.

Another very important consideration concerns the conservation of ovarian function. Roentgenization of the pelvis for uterine fibroid affects chiefly the ovaries, the diminution in the size of the tumor and in the amount of hemorrhage being brought about largely through the effects upon the ovarian tissue. The ovaries undergo atrophy, particularly of the graafian follicles. This effect occurs more readily and permanently in older women; the younger the patient, the longer must be the treatment to accomplish atrophy of the follicles. Nor is the effect necessarily permanent in the younger women because of the powerful regenerative processes in the ovaries. Although Kelly claims radium has a very much less marked degenerative effect upon the ovaries, it is the general opinion of radiologists that radium and the roentgen rays are identical in effect.

But the rays not only influence the ovaries; they also effect the myomatous tissue. Meyer and Grafenberg, Eymer, Bordier, Albers-Schoenberg, and others have subscribed to this belief. Meyer drew his conclusions from the microscopic changes demonstrated in the tumor tissues. Another proof that the tumor tissue is influenced directly is found in the occasional observation of a decrease of volume of the tumor even while uterine hemorrhages persist. Bordier was able to cause by roentgen therapy almost complete dissipation of a large fibroid tumor in a woman whose ovaries had been removed many years previously.

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[1] Jour. Amer. Med. Assoc., 1915, vol. lxiv, p. 1653.

Nevertheless, granting that both roentgen rays and radium may have a direct effect upon myoma tissue, we must agree that the chief influence is brought about through degeneration of the ovaries. The internal secretion of the ovaries may or may not be destroyed according to the dosage administered; the more intensive and the more successful the treatment, the more is there a likelihood of destroying the internal secretions. Surgery, however, conserves the ovaries, or at least one ovary, whenever possible, and this is possible in about one-third of the cases. Bilateral degeneration of the ovaries is a common accompaniment of a fibroid uterus, occurring in perhaps 30 per cent. of the cases. We are sometimes asked why one should balk at radiotherapy for fear of causing degeneration when in nearly one-third of the cases the ovaries are already degenerating? The age of the patient is perhaps the most important consideration in answering this question. When considering the question of preserving ovarian function we must admit that laparotomy is far preferable to radiotherapy. In women who have not passed the menopause at operation it will often prove that myomectomy is sufficient, even the function of the uterus being retained. When myomectomy is feasible its mortality is below 1 per cent.

Diabetes, severe anemia, and serious heart disease have been suggested as contraindicating operative management of myomas. In this class of patients radiotherapy may be definitely indicated, but this is true only to a limited extent, for operations upon diabetics, anemics, and cases of cardiac lesions have been rendered much safer by present-day operative and postoperative methods. Newer methods of anesthesia have diminished the amount of danger involved. It would seem proper to limit the roentgen treatment of fibroids to women whose general health is so much below par, from any cause, that they could not withstand the shock of operation, and to cases of marked anemia due to uterine hemorrhage in which to temporarily control the bleeding until the patient is sufficiently restored to health to undergo an operation. It has happened in my own work that sometimes the patient's condition so improves under ray treatment that she refuses operative treatment.

The expense is about the same for ray treatment as for operation. The ray treatment should only be entrusted to competent and experienced men who have an adequate equipment at their disposal. Pfahler has repeatedly urged the necessity of competence on the part of the physician who administers the roentgen and radium treatment. The operative fee plus the hospital expense is very little if any greater than the fee which a competent radiotherapeutist deserves for his work.

Only cases of uncomplicated intramural fibroids, or cases in which operation is declined or contraindicated by serious organic disease, should be subjected to ray treatment. Possibly there are some extremely neurotic individuals for whom the rays would also be preferable. The ray treatment should not be used when time is a factor, and it cannot be used with safety in rapidly growing tumors, in fibroids complicating pregnancy, or where serious disease exists in the tubes or ovaries. The rays should never be used in any case where complete preliminary curetage with microscopic examination of the curetings is not feasible.

CLINIC OF DR. THOMAS J. WATKINS

ST. LUKE'S HOSPITAL

PERINEORRHAPHY

Summary: A patient with prolapse and hyperplasia of the uterus, cystocele, and rectocele; principles and technic of perineorrhaphy; denudation should not include exposure of levator ani muscle; repair of perineal defect by purse-string sutures; after-care.

THIS patient gives the following history: Mrs. K., age fifty-five years, married thirty-seven years, weight 155 pounds, which is her normal weight.

Family history is negative.

Past history: She has always been well except for an occasional headache, inflammatory rheumatism twelve years ago and some digestive disturbances.

Present illness: Complains of a protrusion from the vagina when on her feet. Walking and standing are attended by a feeling of weight in the pelvis and backache. She has some frequency of urination. Counterpressure is required on the rectocele to empty the bowels when they are constipated.

Births: Ten. No complications during pregnancy, delivery, or convalescence.

Menstrual: Menopause six years ago.

No vaginal discharge. No vesicle symptoms except an increased frequency. Bowels constipated—uses cathartics. Has occasional disturbances of digestion. Sleeps well.

Physical examination: Abdominal, negative. Vaginal: Cystocele and rectocele, both of which protrude on straining. Uterus: Moderate prolapse, cervix 1 inch from vulva. Uterus is 3 inches deep. The diagnosis is prolapse of the uterus, hyperplasia of the uterus due to displacement, cystocele, and rectocele.

The treatment proposed is exploration of the uterus to be followed by hysterectomy or the transposition operation, depending upon the findings as to malignancy or benignancy.

The uterus dilates easily and the curet brings away very little tissue. Vaginal section indicates no suspicion of carcinoma, so that a modified transposition operation is made, excising some of the body of the uterus and the anterior portion of the cervix, leaving enough of the cervix and body to give a firm support to the bladder. As I have written upon this subject frequently of late, the remainder of my talk will be limited to a discussion of the perineal operation.

This subject may be considered threadbare, but the subject is, as we know, not completed, as the operations have not become standardized. As the operation is frequently very badly performed, the results are often unsatisfactory. Techinal difficulties continue to exist notwithstanding that the principles of the operation are comparatively simple and the operative wound is relatively accessible. The operation is especially important, as lacerations of the perineum are common, and there are few operations which give as much relief when good results are obtained.

The physical findings upon examination of the perineum in this case show a large rectocele, which is essentially a hernia of the rectum through the posterior vaginal wall. The levator ani muscle with its accompanying fascia has been injured on each side, mostly in the region of the pubic portion of the muscle, which has permitted the perineum to drop backward in the line of the coccyx. Palpation with the finger on either side shows a very defective muscle with an extensive amount of relaxation.

The principles of all perineal operations should be the restoration of the levator ani muscle and fascia. All other considerations are minor and their discussion only obscures the subject. The principles upon which all perineal operations are based are only two: (1) The shortening of the levator ani muscle and fascia to their normal lengths by sutures which run longitudinally or obliquely in the line of the muscle; (2) uniting the muscles of the two sides in the median line. The first is the principal feature of the Emmet operation. The second is the Hegar operation. All modern operations for repair of the perineum are modifications of these two. The transversus perinei muscle is so unimportant that its individual consideration is unnecessary.

The operation which we propose to do will close as much as possible of the hernial opening through which the anterior rectal wall protrudes. We will shorten the levator ani muscle on either side and unite parts of them together anteriorly to the hernial opening, and thus restore the perineal body to its normal location —near the pubic bone.

Denudation.—The denudation should extend to the upper border of the levator ani muscle. There is nothing to be accomplished by extending it farther into the vagina, as there are no fixed tissues for anchorage above this muscle until the broad ligaments are reached. The denudation may be made by blunt dissection or by removing the mucosa in strips, the choice depending upon the case, as to the presence of scar-tissue, granulation tissue, and the experience of the operator. Considerable has been said pro and con relative to the exposure of the levator ani muscle. After considerable experience with exposure of this muscle, we believe that to do so is usually an error, as it increases considerably the amount of postoperative pain. The amount of bleeding is more, and the results, we believe, not so good as with a more superficial denudation. The reasons for the results not being so good are that sutures of the muscle without the intervention of fascia either cut into the muscle or cause muscular atrophy. It is always well to remember that union of a muscle is by connective tissue, and that there is no such thing as a musculomuscular union without the intervention of connective tissue.

Sutures.—Catgut is employed, as it gives satisfactory results and does not have to be removed. We see no reason for using a non-absorbable suture except an occasional one in a case of complete laceration. It is a rule that too many sutures are used for the size of the wound, as the perineal wound is rather small except when put on the stretch. The reason why an excessive amount of suture material is generally used is because the wound is much stretched while most of the sutures are being introduced.

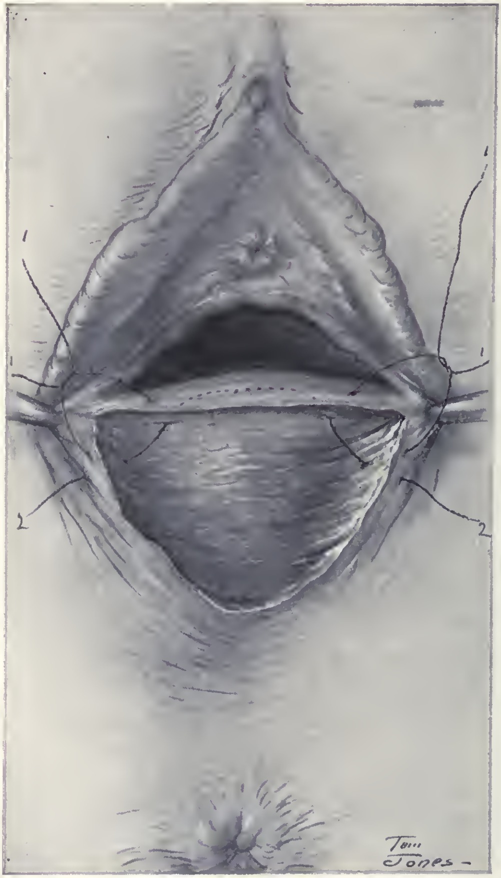

Fig. 221.—The denudation extends from the skin to the border of the levator ani muscle—nearest to the cervix. Sutures 1 and 2 are inserted.

Figure 221 shows the closure of the angle of the wound to either side of the vagina with No. 2 iodin catgut. Care should be taken that this suture includes the vaginal artery on either side, which is almost invariably present and injured. Any other bleeding points should be attended to at this time by suture or ligature. The suture at either side is tied and cut. The second suture introduced is the same suture that Emmet called the "crown-stitch," and is here inserted solely for the purpose of insuring complete closure of the vaginal wound. This suture is

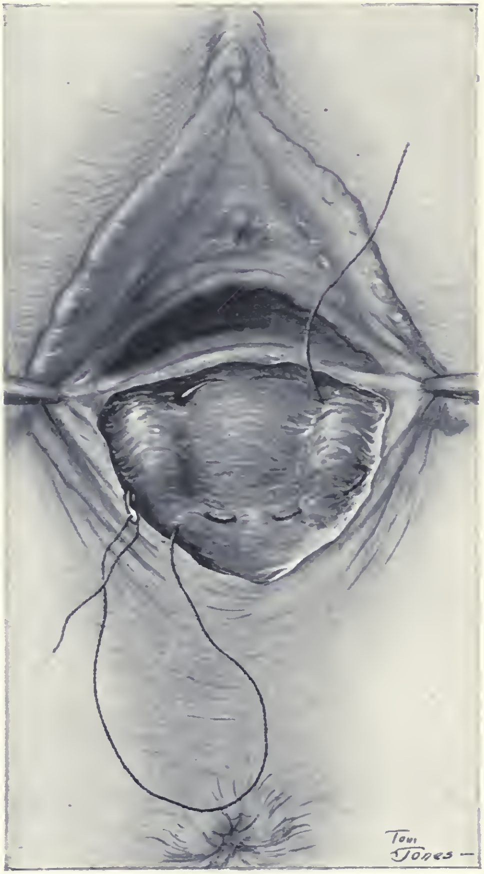

Fig. 222.—The "purse-string" of the rectocele is illustrated unobstructed by the presence of sutures 1 and 2 which are shown in Fig. 221. The position of the needle shows the location and depth of the suture at the sides.

not tied until the rest of the wound is closed in order to simplify the introduction of other sutures. The third suture in Fig. 222 is a purse-string suture, which includes a liberal amount of the levator ani muscle—the pubic portion—on either side and extends across the lower border of the rectocele, which is the anterior portion of the triangular ligament. This suture when tied, closes the hernial opening of the rectocele as completely as it seems possible to do. In the case of a very large rectocele its size is lessened by inserting one or two purse-string sutures over the rectocele, using fine suture material in a small non-cutting needle. This minimizes the amount of "dead space" and lessens the danger of bleeding. The danger of bleeding into this space is considerable if one does not use

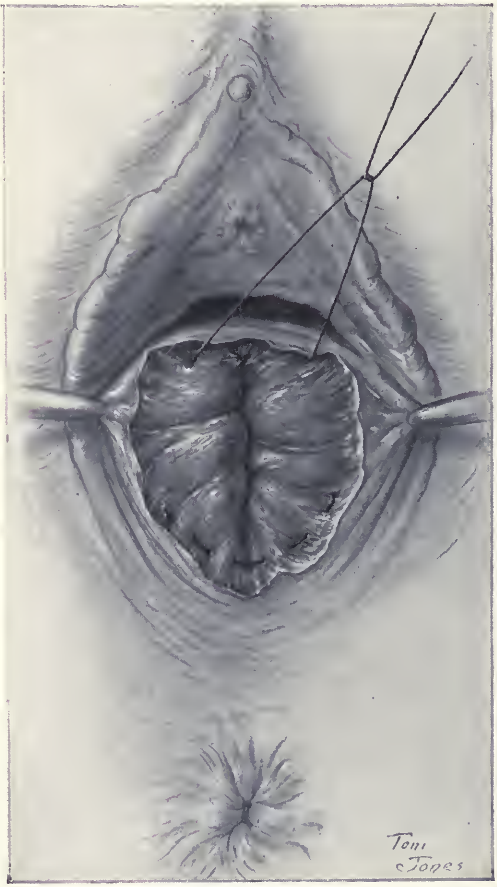

Fig. 223.—The first "purse-string" suture is tied and a second one is inserted.

care in regard to it. In Fig. 222 sutures 1 and 2 are omitted to simplify the illustration. The result of the purse-string suture when tied is shown in Fig. 223. Observation of the result of this suture shows that the hernial opening has been

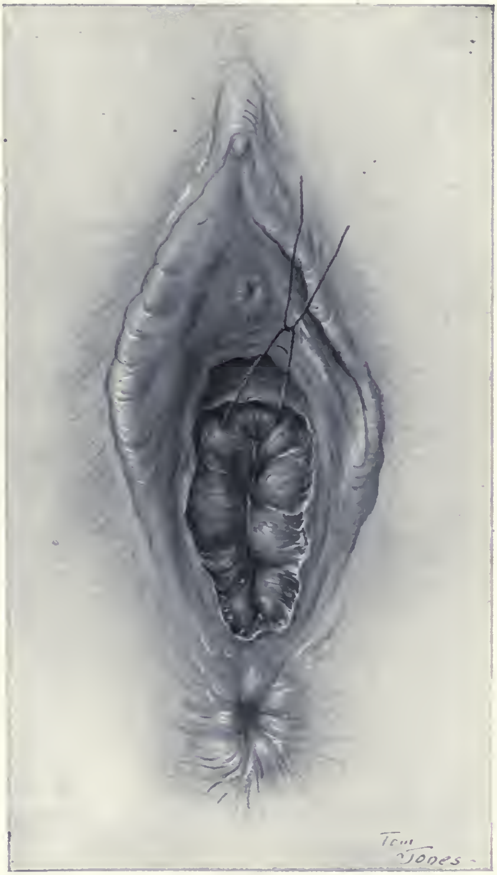

Fig. 224.—A third "purse-string" suture is used in extensive tears.

completely closed, and that the triangular ligament has been drawn forward and inward in the line of the pubic bone. The perineal body is correspondingly replaced anteriorly. Figure 223 shows a second purse-string which reinforces the first and lessens the size of the wound and continues to draw the perineum forward and inward. Figure 224 is the third purse-string suture which is used in extensive lacerations, but is not needed in smaller lesions, and has the same effect upon the wound as the previous suture. Figure 225 shows the wound closed with a subcuticular suture, which should be so placed as to give accurate approximation. This suture materially lessens the postoperative discomfort, and is not so easily accessible to the vaginal bacteria as sutures which include the mucosa and skin. The "crown-stitch" suture is tied at the end of the operation.

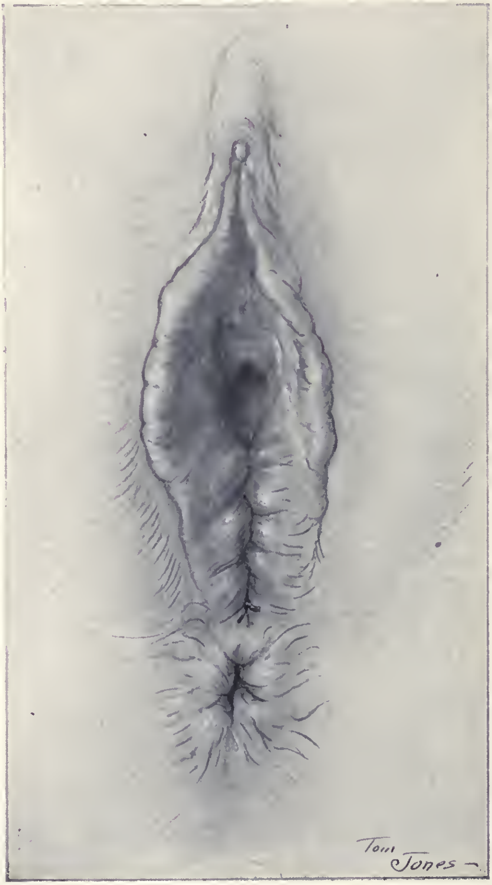

Fig. 225.—The closure of the wound is completed by a subcuticular suture.

The after-care of perineal cases has become very simple. Douches are not given. Very little dressing should be kept over the perineum, so that the surface will remain dry. The use of thick dressings keeps the wound moist and unsealed. Normal urine does not injure the wound, but may produce some irritation if allowed to decompose. Consequently, a cleansing solution is poured over the perineum after each urination and the wound is dried. The patient is allowed to get up as soon as she desires. She is cautioned against straining in emptying the bladder or bowel. The test as to the result which we have obtained will consist in observation of the place which the perineal body now occupies, which is near the pubic bone. Palpation over the levator ani muscle on either side of the newly formed vaginal canal shows a thick muscle which does not readily yield to pressure.

CLINIC OF DR. CAREY CULBERTSON

PRESBYTERIAN HOSPITAL

THERAPEUTIC ABORTION AND STERILIZATION

Summary: A patient, twenty-three years of age, pregnant, and presenting symptoms of neurasthenia, enteroptosis, incipient pulmonary tuberculosis, and hyperemesis gravidarum; discussion of the general indications for therapeutic abortion; importance of tuberculosis and its bearing on the present case; desirability of sterilizing patient at the time abortion is done; vaginal and abdominal routes for producing abortion; technic of abdominal cesarean section in the early weeks of pregnancy; methods of sterilization; detailed technic of a method which, while thorough, permits the subsequent restoration of fertility; note on ether-gas-oxygen anesthesia for laparotomies.

THE case for demonstration at this time presents the following history and clinical findings:

The patient is a young woman, twenty-three years of age, housewife, who has been married four years. Her complaint is as follows: The last two menstrual periods have been missed. She is nauseated all day long and constantly vomiting; unable to retain food. For the past two weeks she has been confined to bed. For the past year she has complained of fatigue on effort. She is tired when she gets up in the morning. The weariness is only relieved by lying down. She does her own housework and cares for her children, and as a result of the household responsibility and continued fatigue has become very nervous and irritable. Before her marriage she claims to have weighed 143 pounds. Her present weight is 113 pounds. In addition to this, she complains of pains, especially in the right leg and in the perineal region, and severe and constant backache, which is not relieved by lying down.

She began menstruating at fourteen. Her periods were regular, every twenty-eight days. Since the birth of her first child they have been rather profuse, lasting now seven or eight days, whereas before her marriage they lasted four days. There is no dysmenorrhea. Her last period occurred on October 15th. There has been some recent vaginal discharge. There are no vesical symptoms, but she complains of chronic constipation, requiring more or less catharsis daily to secure bowel movements. Her appetite has not been good for a long time, a year or more, and she eats very little food. Her children are three years and fifteen months of age respectively. Her pregnancies were normal except for a moderate amount of emesis in the early months. Her labors were both spontaneous. There have been no miscarriages. This patient has been under the care of an internist for the past two or three months. She has been treated for nausea and vomiting and for her other general complaints by rest in bed and diet, without, however, any very considerable relief.

Examination shows her to be a slender, undernourished young woman, with little subcutaneous fat. Her pulse is rapid and slightly irregular, but the heart shows no valvular lesion and no evidence of myocardial changes. Expiration is prolonged over the right apex and râles have been observed here from time to time. There is a slight enlargement of the median lobe of the thyroid gland. Her abdomen is lax, diastatic and striated, and there are no tender points. There is a small, round, firm mass palpable just above the symphysis and behind it, which is free and not tender. The vagina is slightly relaxed, deep, and distensible. There is an evident cyanosis. The cervix is multiparous, soft, patulous and free, and points downward and back. The corpus is upright, anteflexed, enlarged, soft, and resilient, and it is identical with the mass palpable through the abdominal wall. There are marked varices of the vulva and of both legs.

Laboratory examination in this case shows the following: Sputum is negative for tubercle bacilli. The urine shows no albumin, casts, nor pus cells. Hemoglobin is 70 per cent. There is a leukocytosis of 11,600. Her temperature has been somewhat variable, but never high, 99.6° F. being the highest that it has gone since she has been under observation, but it has been over 99° F. nearly every day for the past three weeks. There is a notation in the record that inflation of the stomach reveals considerable descensus on the part of this organ, the lesser curvature coming down as far as the umbilicus, the greater curvature as far as the pelvis. The right kidney is distinctly palpable below its normal position, the left not so definite.

This case presents the following proposition: We have here a young woman who has had two children, the last only fifteen months ago, who is now pregnant for the third time; who has suffered for a considerable period of time from that train of symptoms which characterizes enteroptosis; and in whom there is a possible lesion in the right pulmonary apex. Her irregular and rapid pulse may be explained by the moderate enlargement of the thyroid. The previous diagnosis of enteroptosis and neurasthenia, which has been made by the internist, is readily concurred in, the neurasthenia being frequently due to the general ptosis which these cases present. Ptosis is a very frequent finding in this type of woman—thin, undernourished, poorly muscled—being but one expression of the general muscular deficiency which obtains. These patients, ambitious to maintain a home and properly care for their children, are not lazy, but as a result of the continued and repeated drag in the abdomen experience this marked fatigue on effort, which is only relieved by getting off their feet. The varicose veins of the vulva and limbs are merely other expressions of this same general condition. We have further a probability of an early incipient tuberculous process in the apex of the right lung. While the tubercle bacilli have not been recovered and the patient has had no cough or expectoration, nevertheless the presence of râles and the prolonged expiration in this region is certainly suggestive of an approaching tuberculosis. Taking all these conditions together, it has seemed best to interrupt this pregnancy. In view of this fact, the patient and her husband have both requested that whatever seems best should be done to prevent subsequent pregnancies, at least for the present. Such a proposition is entirely agreeable to the physician for the reason that so often where therapeutic abortion is undertaken in a case of this sort, and some method of sterilization is not done, one has only to repeat the abortion in a few months, a feature of the case which is very undesirable.

While I would not go so far as to state that this patient is suffering from hyperemesis gravidarum, yet the fact that careful treatment in bed has not alleviated the vomiting is suggestive.

In considering, then, therapeutic abortion as the best thing at this time in this patient, I desire to outline very briefly the indications for its use. Without going into the legal or moral phases of therapeutic abortion, the following indications may be stated as those which are generally accepted today:

(1) Contracted pelvis, where the conjugata vera is 6 cm. As a matter of fact, this is an old indication, which in the majority of clinics does not stand today, since we prefer now to let such a case go to term and to treat it by cesarean section, at which time sterilization may be performed or not, as seems best.

(2) Hyperemesis gravidarum and the toxemia of pregnancy. These two conditions are accepted as good indications today, the hyperemesis implying, of course, that the patient has been under treatment without avail, and that the condition is more than the mere nausea or vomiting of the early weeks of pregnancy, and that the patient has lost weight from her inability to assimilate food. Toxemia of pregnancy gives us one of the best indications for therapeutic abortion, so that, as a matter of fact, the claim may be made at this time that no pregnant woman need go on to convulsions. In the majority of cases, of course, the toxemia improves under careful treatment.

(3) Tuberculosis. This, in my opinion, is one of the best indications that we have for therapeutic abortion, particularly where the tuberculosis is active or, in other words, advancing. In latent tuberculous processes there will arise, of course, the question as to whether abortion is necessary or not.

(4) Heart disease. Certain valvular heart lesions, certain myocardial lesions, and degenerative processes may stand pregnancy and labor without any great harm, but the great majority of valvular lesions are made worse by pregnancy and

labor, particularly the stenotic lesions, all of which give a more or less unfavorable prognosis.

(5) Diseases of the kidney. Like cardiac and pulmonary lesions, nephritis may not warrant therapeutic abortion, but this lesion will show exacerbations during pregnancy, and, especially if a retinitis has developed, provides a very urgent indication for the termination of the pregnancy.

(6) Diabetes and other constitutional diseases aside from those given, where we have only a relative indication for the termination of pregnancy. In some cases it is undoubtedly the best thing. In other cases the pregnancy may safely enough be maintained.

(7) Retroflexion. This is only an indication for therapeutic abortion where it is impossible, for some reason or other, to restore the uterus to its original position in the hope of maintaining the pregnancy intact.

(8) Hyperthyroidism, leukemia, pernicious anemia, epilepsy, and chorea are also but relative indications for the termination of pregnancy. Certainly it would seem that pernicious anemia should be so managed. The great majority of clinicians deem it wiser that a woman suffering from epilepsy and chorea should not reproduce.

(9) Diseases of the ovum, such as polyhydramnios, vesicular mole, death of the fetus, etc., are indications rather for emptying the uterus in the way of treating the disease than for a therapeutic abortion, which implies a destruction of the fetus. Where the fetus is already dead or where diseases of the ovum, such as vesicular mole, are usually not associated with the development of the fetus, these conditions do not come in properly as indications for therapeutic abortion. Closely allied with the nervous diseases just mentioned are insanity, idiocy, etc. Here we have certainly, from a sociologic point of view, a very good reason indeed for not only terminating but preventing pregnancy. Various other conditions have been offered by different writers as indications, such as cancer of the uterus and other malignant growths, hemorrhages in the early months, eclampsia, etc. As a matter of fact, these conditions tend rather to take care

of themselves, though there will be instances where, the pregnancy not terminating spontaneously, artificial abortion becomes necessary later.

With respect to this particular case and the imminence of the tuberculous process it has been shown by Kunreuther that 73 per cent. of tuberculous patients get worse during pregnancy and 49 per cent. of them die; that there are exacerbations of the tuberculous process during pregnancy in 68 per cent. of the cases which have become stationary. In one series of 1035 cases 95 per cent. grew worse during pregnancy. In another series 50 per cent. grew worse or died.

It is always desirable, in performing a therapeutic abortion and some operation for sterilization, to limit this work to those women who already have children. It should always be done in a good hospital and under the very strictest aseptic precautions. The methods may be classified as follows:

A. Vaginal:
  1. Bougie or sound or tent.
  2. Injection of fluids into the uterus.
  3. Tampons or colpeurynter.
  4. Dilatation of the cervix and removal of the ovum by instruments or with the fingers.
  5. Vaginal cesarean section after the twelfth week.

B. Abdominal:
  1. By hysterotomy; that is, cesarean section.
  2. By hysterectomy.

C. With intensive doses of *x*-ray or radium.

Without going into these methods in detail, it will suffice to say that the bougie, injection of fluids into the uterus, and tampons are not desirable methods in hospital practice. Dilatation of the cervix and removal of the ovum at one sitting is a very excellent method of terminating pregnancy in the early weeks, and, where nothing further is to be done, is perhaps the most desirable, except that it should always be remembered that any invasion of the uterine cavity by the vaginal route is always attended by the danger of infection. After the twelfth week, as has been stated, vaginal cesarean section is the better method, particularly in those cases where the cervix does not dilate readily. The abdominal methods are most generally employed at term. They may be employed earlier, as will be demonstrated in this particular case. The use of x-ray or radium for the termination of pregnancy has not been generally employed and is not only problematic, but still in the experimental stage.

In this particular case it has been decided to empty the uterus through the abdomen and then to perform a conservative sterilization procedure that will now be demonstrated. The abdominal wall is opened by a high incision, commencing just below the umbilicus and terminating three fingerbreadths above the symphysis. Before opening the peritoneum the patient is tipped into the Trendelenburg position, so that the intestines will have fallen away when the peritoneum is incised. The reason for this high incision will be brought out later. After the abdomen is opened and retractors in place, the intestines are packed off. The uterus is then grasped by a volsellum just anterior to the midline of the fundus, and is drawn back toward the promontory of the sacrum. The conditions in this case are as follows: The uterus is enlarged about three times its normal size and is soft and free. Both tubes are straight and free except the left one, which is slightly adherent near the left ovarian ligament and to the left ovary. The right ovary is small and firm. The left is moderately enlarged by the corpus luteum. There are marked varicose veins in both upper broad ligaments between the tubes and ovaries and in the infundibulopelvic ligament. The appendix is retrocecal and is adherent at its tip and 4 inches long. The cecum is very mobile. The greater curvature of the stomach comes well below the umbilicus. The transverse colon comes into the false pelvis. The right kidney has an excursion of 4 inches; the left, of 2½ or 3 inches.

After the uterus has been grasped and pulled back toward the promontory of the sacrum an ampule of pituitrin is injected into its anterior wall. We now wait about thirty or forty seconds for this to produce a contraction of the uterus, and as soon as the uterus is firm, as it is now, we make a longitudinal incision in its anterior wall about 2 inches in length. As the incision is made the uterine wall gapes open, as you see, and the gestation sac begins spontaneously to extrude. It comes out of the uterine cavity unruptured. You have here the entire ovum unruptured, covered on its entire circumference by the chorionic villi. They are matted together in areas by portions of the decidua which has torn away with the ovum. That most of the decidua, however, has remained attached to the uterine wall is evident. This can be removed very well by merely scraping it out of the small uterine cavity with the gloved finger. It is not necessary to use a sharp curet, or a dull one either, for this purpose. As a matter of fact, the cervix is soft and patulous in pregnancy, and whatever portion of the decidua must come away will readily do so by drainage through the cervical canal.

The uterus is now held together by the fingers of the assistant, and its incised walls are sutured. This is done in a two-stage method exactly similar to the method we employ in cesarean section at term, except that there we close the uterine wall by a three-stage suture instead. The first row of iodin catgut takes in the inner half of the uterine wall at either side, not including the decidua, and is a continuous suture. The second is a continuous suture and takes in the rest of the uterine wall, including the peritoneal layer. It is sutured in such a way that the peritoneal fold is inverted into the wound, so that when this is accomplished no further peritonization is necessary. The uterus having now been closed, the next part of the operation includes the sterilization procedure. This brings us to a discussion of sterilization.

This operation is done by a great variety of methods, all of which, however, may be classified into two groups, those of the vaginal route and those of the abdominal route.

(1) Vaginal route:

A. Atmocausis and zestocausis, that is, a destruction of the mucous membrane of the corpus by superheated air or live steam, a method which was developed by Pincus some years ago.

B. Electrocauterization of the tubal openings through the uterus, a method which has been recently advocated by Dickinson.

C. Colpotomy for the treatment of the tubes or ovaries. This is done either through the anterior or posterior vaginal vault, and usually consists in either bilateral salpingectomy or else a resection of the uterine ends of both tubes.

(2) Abdominal route:

A. Hysterectomy, as has been advocated by Kunreuther.

B. Resection of the tubes partially or completely or some plastic procedure on the ovaries.

The treatment of the tubes or ovaries by the vaginal route is based upon the same principles as when they are treated by the abdominal route. With a resection of the uterine ends of the tubes the most important thing is the method by which the uterine ends are closed, no matter whether the operation is performed from below or by abdominal section. In presenting this case we will discuss only the methods followed when the operation is attempted by the abdominal route. As hysterectomy is never desirable or necessary, we will omit it. Likewise we will not consider oöphorectomy. This leaves us free to discuss merely the methods of tubal sterilization. Recently excellent and thorough reviews of these methods have been offered by Heineberg and Littig. The older and more simple methods, such as ligation and division of the tubes or crushing of the tubes with or without ligation, have been shown by the two operators just cited to be entirely inadequate. The reasons for this are not difficult to understand. Suffice it to say that cases treated in this way have subsequently become pregnant. I prefer to speak, then, only of the more recent methods of tubal sterilization. There are two groups of these. First, those operations upon the uterine end of the tube, such as have been proposed by Beuttner, Kirshoff, Van Meter, Taussig, Rissmann, Holzapfel, de Tarnowsky, and Rocky. These methods closely resemble each other in many particulars. They involve a resection of the tubes from the uterine wall, and in every case closure of the uterine horns. The free end of the tube is disposed of in various ways. De Tarnowsky's method has the advantage over the others that it makes a subsequent restoration of fertility possible. This is the only one presenting that advantage. The second group consists in operations upon the fimbriated ends of the tubes. These have been presented by Blietz, Stetten, and Stoeckel. Here the fimbriated end of the tube is freed more or less from its attachments and is disposed of in various ways. In one instance it is brought up through the inguinal ring to the abdominal wall. In another instance it is brought up directly through the abdominal wall beneath the skin. A third group might include those procedures whereby the entire tube is rolled up in a fold of the broad ligament, where it is buried by continuous catgut sutures.

Simultaneous abortion and tubal sterilization is not an original procedure, it having been introduced into the literature by Hofmann, Sellbaum, Andreas, and Findley. These operators empty the uterus as has just been done, and all resect the uterine ends of the tubes except Findley, who advocates a resection of the entire tubes.

As you see, the uterus is still grasped by the volsellum and the fundus is still held back toward the promontary of the sacrum. Now I seize the left ligament about 6 cm. from the uterine horn and lift it up. This permits the two layers of the broad ligament to fold together beneath it, thus producing a clear space. A long forceps is now passed through the bottom of this clear space, from before backward, by means of a small incision. It is made to seize the fimbriated end of the left tube. This is now pulled through into the anterior culdesac and stitched by a single through-and-through catgut suture to the bottom of the anterior culdesac. This is a light, simple suture not involving the entire tube lumen or closing it in any way. The right round ligament is now seized and elevated similarly. The forceps is passed beneath it through the broad ligament, and the right tubal infundibulum is brought forward and fixed in the same manner (Fig. 226). Now I remove the anterior blade of the retractor and catch the free peritoneal edge at a central and two lateral points by three forceps in order to lift it well into the abdominal wound. The fundus of the uterus is now brought forward under the lower angle of the abdominal wound. In making my original abdominal incision I took care to dissect the superficial fascia well back on both sides of the lower angle of

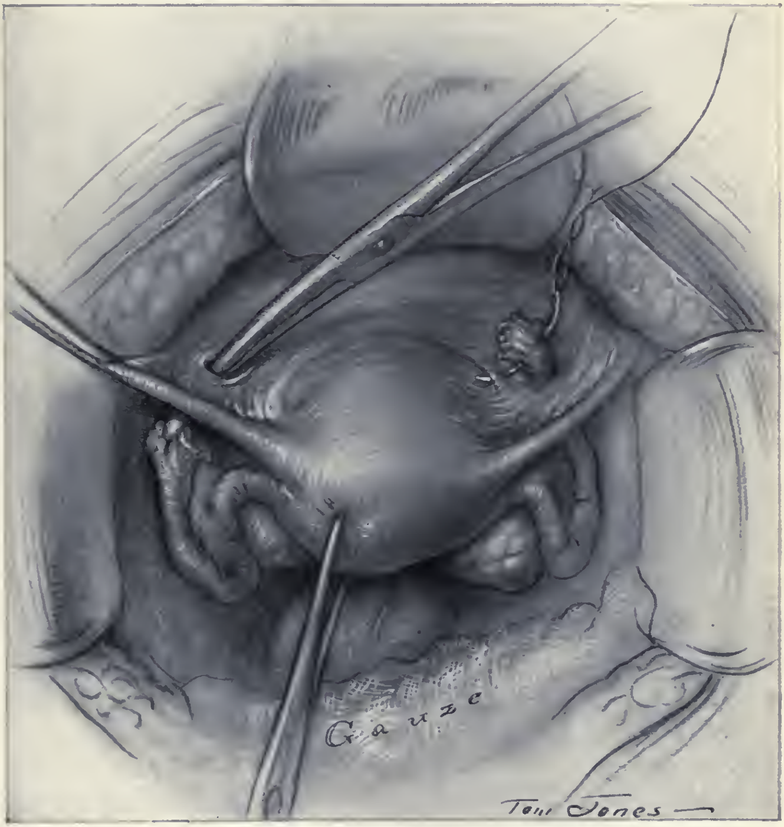

Fig. 226.—The fundus of the uterus is retracted toward the promontory of the sacrum. The left round ligament has been seized by forceps 6 cm. from the uterus and raised up. One inch below its edge an 8-inch clamp has been passed through the folds of the broad ligament and made to seize the fimbriated extremity of the left tube. The fimbriated extremity of the right tube has been transposed beneath the right broad ligament by a similar maneuver and is being lightly stitched in the bottom of the anterior culdesac.

the wound. The skin is now retracted over this, and I place a linen mattress-suture through the abdominal wall into the uterus and out again. This passes from without inward and

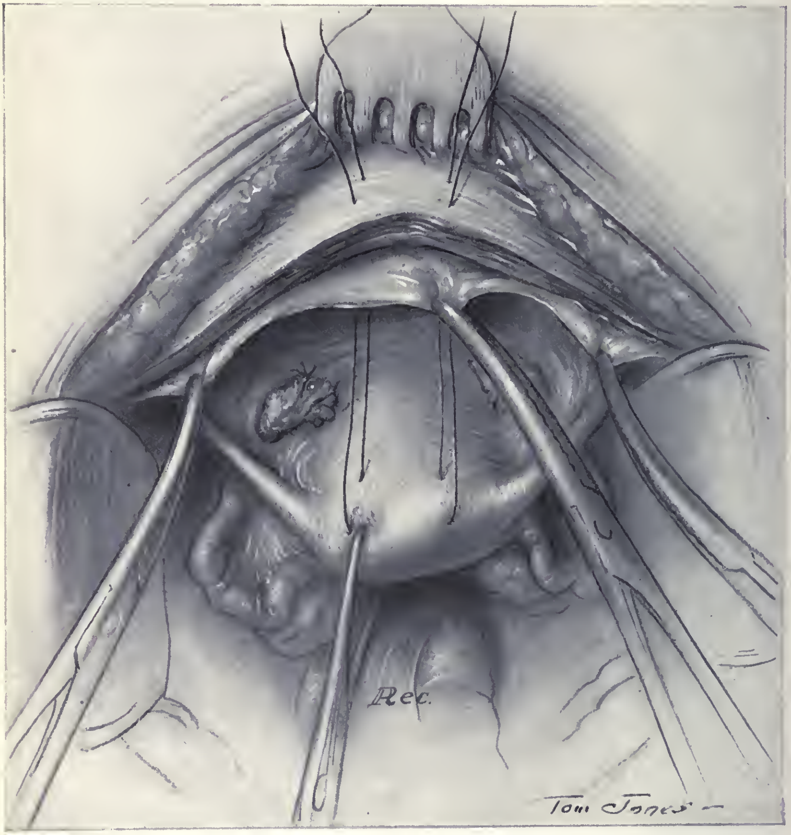

Fig. 227.—Fimbriated extremities of both tubes stitched in the anterior culdesac. The anterior retractor has been removed and the peritoneum grasped at one median and two lateral points and pulled up into the wound. The skin at the lower angle of the wound is pulled down with a hook retractor. A stout linen thread is then passed through fascia, muscle, and peritoneum into and through the uterine wall just inside of the round ligament and out again through peritoneum, muscle, and fascia. One of these is passed on either side, forming two mattress-sutures.

close to the median line through the superficial fascia, rectus, and peritoneum into the uterine wall, well up in the convexity of its fundus, and then out again through the peritoneum, muscle, and fascia. I now pass a similar mattress-suture just to the right of the median line (Fig. 227). We will not tie these sutures, but merely secure them by forceps and leave them temporarily. If I should tie these ligatures now I would have difficulty in accomplishing the next procedure. The abdominal wall is now lifted well up with a broad flat retractor, and, beginning at the point where the left round ligament passes into the left inguinal canal, I stitch the round ligament to the anterior parietal peritoneum with a continuous iodin catgut suture. This suture is carried down the entire length of the round ligament to its union with the fundus uteri. I take pains to stitch through the ligament, not about it, and through the peritoneum into the inferior fascial sheath. As I reach the fundus of the uterus my last stitch is an interlocked one, to keep the suture from loosening. The fundus of the uterus is adjusted forward so that the lower angle of the peritoneal incision is well above it. With another iodin catgut I now begin at the right inguinal ring and stitch the round ligament in the same manner to the anterior parietal peritoneum on the right side. Again, when I reach the uterus, I use an interlocked suture. I now tie the two linen mattress-sutures. This brings the fundus of the uterus well up under the anterior parietal peritoneum (Fig. 228). In order to finish the line of partition that I have made between the anterior culdesac and the rest of the peritoneal cavity, and at the same time to bury the linen sutures, I now continue the catgut from the left side to the right, that is, from one round ligament to the other. In other words, I stitch across the uterine fundus and bring the line of peritonization well back over it between the tubal insertions, so that the linen sutures will be excluded from the abdomen. Next with a single light catgut over-and-over suture I close the hole in the broad ligament, where the left tube was brought through into the anterior culdesac. The hole on the right side is closed in a similar manner. What I have done is this: I have transposed the infundibulum of the tube beneath the round ligament into the anterior culdesac. I have then closed the anterior culdesac by a transverse method of suspending the uterus, employing the round ligaments throughout their entire length, from the inguinal ring on one side to the inguinal ring on the other (Fig. 229).

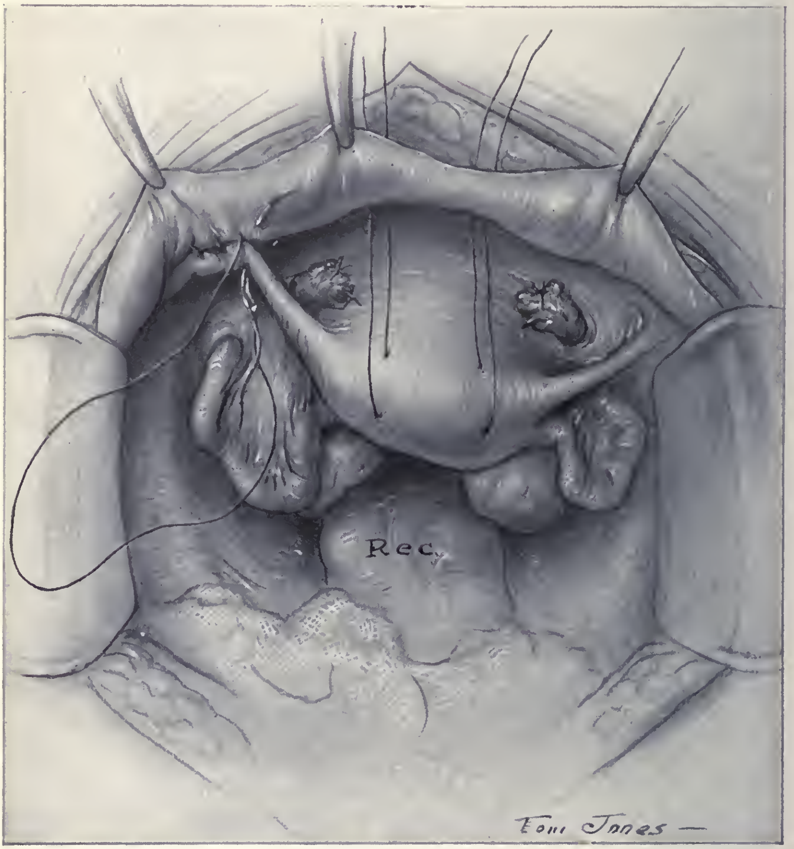

Fig. 228.—The two linen mattress-sutures are not tied, but merely held temporarily by forceps. With a light catgut thread the round ligament is now stitched to the anterior parietal peritoneum, commencing at the point where the round ligament enters the inguinal canal and stopping with an interlocked stitch where the round ligament joins the uterine wall. The opposite round ligament is treated in the same manner, beginning at the inguinal ring. The linen mattress-sutures are then tied.

This method of ventrosuspension is not new, but is one which I have used occasionally in fixation of the uterus after salpingectomy, and the after-results have been so favorable as to warrant its further application, as on this occasion. The advantages of this procedure are that it is conservative, not requiring the extirpation of any structure or even the ligation of any large vessel. It avoids the anterior abdominal pillar formation, such as has been the objection in the Kelly suspension or Gilliam round ligament shortening, or in certain methods of operating upon the fimbriated ends of the tubes. It affords an excellent suspension of the ovary, as you can see. It ensures drainage

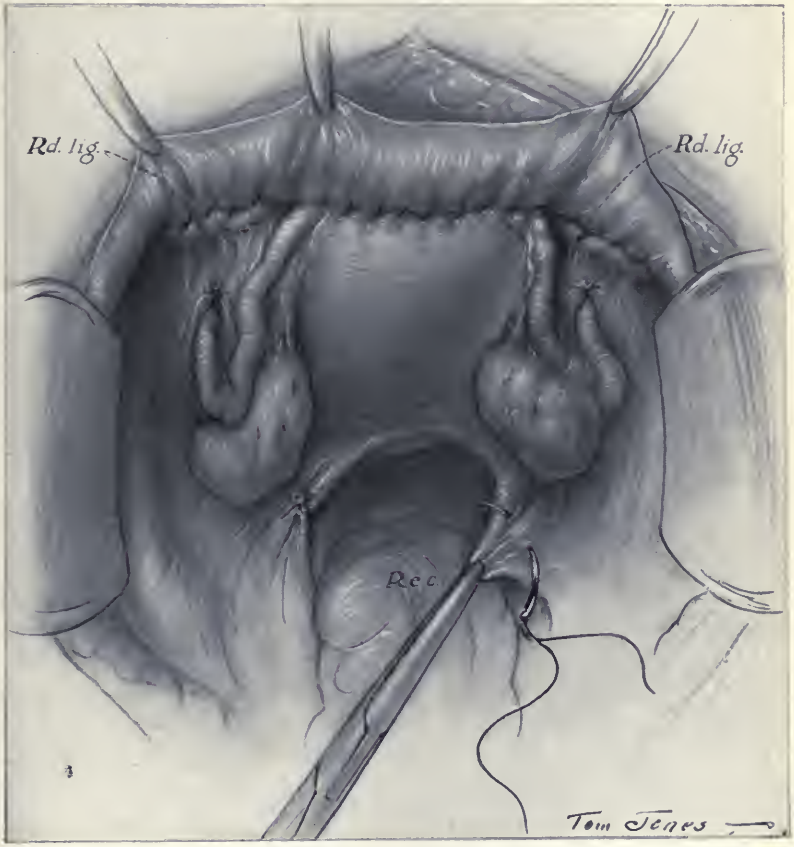

Fig. 229.—Operation completed. After tying the linen mattress-sutures the anterior parietal peritoneum is stitched well down over the fundus of the uterus by continuing one of the continuous catgut sutures from its side to the opposite side. The two holes in the broad ligament through which the tubes were drawn are now lightly closed with a few stitches. This figure also shows a plication method of shortening the uterosacral ligaments.

of the tubes. The anterior culdesac is left large enough to accommodate the bladder, so that there are no postoperative vesical disturbances. It is a simple and effective operation, and may even be adapted to retrodisplacements of the uterus, as it gives an excellent fixation, especially if accompanied by a shortening of the uterosacral ligaments. It is the best procedure so far suggested for the subsequent restoration of fertility. This would be accomplished readily by separating the adhesions along the line of ventrosuspension. The tubes could be freed from the broad ligament or could be cut off close to the broad ligament and a cuff turned back, as was suggested originally by Martin. I have performed this procedure twenty-five or more times for tuberculosis, nephritis, contracted pelvis, and valvular heart lesions, and I have associated it with repair of complete perineal lacerations and with high amputation of the cervix. It has even been made part of a conservative procedure for the cure of procidentia uteri, though I would not consider it adapted at all to cystocle or rectocele as such. I have limited the procedure to patients who have had living children. As a rule I have limited it to young women. As far as restoration of fertility goes, I can only say that up to the present time there has been no occasion to attempt that.

Finally, I desire to call attention to one other feature of this operation, that is, the anesthetic. This patient was anesthetized with ether, and the ether was continued until she was placed in the Trendelenburg position, the abdomen opened, and the intestines packed off. The ether was then taken away and nitrous oxid and oxygen were substituted. The entire operation and the closure of the wound has been done, therefore, under nitrous oxid and oxygen. The important thing in the use of gas in major operations as well as in minor is to avoid cyanosis. This requires, of course, a trained anesthetist. The patient, as a rule, is awake by the time she returns to her room. There is little or no postoperative gastric distress and our patients require less general postoperative care. As a rule there is no nausea or vomiting and no shock. It has become my routine anesthetic for laparotomies. I have used it now in 125 consecutive cases with such excellent results that I am encouraged to continue.

CLINIC OF DR. ARTHUR H. CURTIS

St. Luke's Hospital

REMARKS ON SALPINGITIS

Summary: Prophylaxis of salpingitis—vaginal douches in acute gonorrhea are pernicious; indications for operation; characteristics of appendicitis secondary to salpingitis which influence indications for operation; focal infection of the pelvic organs—fundus of the uterus rarely a chronic focus.

It is well to retain uppermost in our minds certain clinical essentials which have been learned through hard experience. Most important of these in the prophylaxis of salpingitis is rest in bed; it is the best protection from this disaster and from other complications which beset patients with active gonococcal infection.

Other measures of much value include free elimination, regulation of diet, and judicious use of urinary antiseptics. A bland diet, with little meat and no seasoning except salt, helps much. Perhaps the most efficient of urinary antiseptics is urotropin in doses sufficient to yield a positive Rinini test for formalin. If more than 15 grains t. i. d. are required to secure a positive test, another remedy should be given preference. In the presence of alkaline urine, combined urotropin and benzoic acid treatment do good service; the latter is administered in 5- or 10-grain capsules three or four times daily.

Treatment of the external genitalia during acute infection appears of little help in modifying the course of gonorrhea in women. On the contrary, manipulations sometimes force bacteria into the deeper tissues, prolong the course of the disease, and tend to spread infection.

The use of vaginal douches in acute gonorrhea is pernicious. Salpingitis in women who have refrained from douches is infrequent; such cases occur, but much less often. It is illogical to wash a pus-laden urethral discharge into the vaginal canal, as must occur with self-administered douche treatments. Again, in the process of douching the vaginal walls, the cervix, frequently the seat of infection, is flooded with solution; it must occur that gonococci washed into the vagina, or picked up from the vaginal portion of the cervix, are swept through the protective internal os up into the uterine cavity and beyond.

In quiescent and chronic gonoccocal infections procedures aimed to eradicate the disease may be useful. But where pus or numerous bacteria persist we should meddle little, should shun the douche bag, and should remember the value of rest in bed aided by thorough elimination.

Indications for Operation.—Roughly estimated, 50 per cent. of patients with salpingitis progress to symptomatic recovery.

Of the remainder, one-half give history or yield physical evidence of residual pelvic lesions without disease sufficient to necessitate interference. The others require operation for relief.

Unquestionably, as time goes on, fewer of these patients will be operated. We can look toward the time when operation will be advised chiefly for two groups of cases: for complications, such as appendicitis and intestinal obstruction, and for the results of infection, notably adhesions.

Appendicitis Secondary to Salpingitis.—Here let us digress for a moment to consider appendicitis which complicates salpingitis. Not infrequently this causes the surgeon intense anxiety. It should rarely do so, for it seldom necessitates emergency operation.

If we think of the dangers in primary appendicitis we realize they are due to obstruction of the lumen or occlusion of vessels. The former leads to perforation or rupture, the latter to gangrene.

In the nature of things, appendicitis secondary to salpingitis develops without these emergency complications. The appendix is attacked *from without*, commonly near the tip at first. Distention of the distal end, from primary involvement of the mucosa, does not often occur. Likewise there is little tendency to obstruction of the circulation. Appendicitis secondary to salpingitis, therefore, is rarely an emergency complication, and operation can be safely delayed until such time as is most suitable for the pelvic part of the work. Recognition of this point is imperative; it means removal of the chief temptation to open the abdomen of patients who suffer from acute pus-tubes.

A Social Indication.—In the clinic we encounter another indication for operation upon patients with tubal infection. It is the presence of financial difficulties. These cases often cannot afford to remain long idle, nor can they withstand the expense of prolonged medical care. They overdo or overindulge before complete recovery, and recurrence follows. To prevent this frequent course and to stop the promiscuous spread of venereal disease by such patients we operate many of the more severely infected ones upon subsidence of acute symptoms. It is a social necessity which forces an operative interference otherwise avoidable or capable of postponement.

Notes on Focal Infection.—To the enumerated classes which require operation we may add a final group. These are the patients with chronic focal infections of the pelvic organs, the presence of which gives rise to recurrent systemic disorders. These exist, but my present thought (gonorrheal arthritis excepted) is that they are infrequent.

Now in the ward under observation is a patient with deforming arthritis. In addition to her misshapen joints there is an enlarged spleen. She has a profound anemia. History, physical examination, symptoms, all suggestive clues have yielded our internists nothing in addition to a complaint of purulent vaginal discharge and pelvic distress. We find the left Bartholin gland enlarged. Skene's ducts are thickened, but yield no gonococci on stripping. Two vaginal examinations showed no pus, but upon a third occasion a gush of foul purulent discharge poured from the vulva. Its origin, as yet uncertain, was probably a Bartholin gland. The uterosacral ligaments are shortened, rigid, and tender, the well-placed uterus of normal size, its cavity free from pus and bacteria. Tubes and ovaries are negative. In the discharge is much pus and bacteria, with Gram-positive diplococci most abundant. This patient, with chronic infectious arthritis, anemia, and large spleen, in whom repeated efforts fail to disclose history or symptoms of infection elsewhere, requires removal of her diseased pelvic tissues.

There is a second case of this kind which I have recently seen. The wife of a doctor, a patient of Dr. Watkins, suffered from a non-gonorrheal, offensive, profuse discharge of pus which had poured from the vagina for years. The patient's health became greatly undermined. No source of pus formation could be found in the external genitals. The uterus and tubes were removed, but yielded neither pus nor bacteria upon most painstaking study.

In making mention of these two cases I wish to avoid emphasis of the pelvic organs as centers from which systemic troubles arise. Gonorrheal arthritis excepted, I suspect the pelvic tissues of women do not often harbor active focal infections.

Focal Infection in the Uterus.—The frequency with which infection lodges in the endometrium is worthy of more thought and study than has been accorded it. The endometrium is a supposed hot-bed of infection. It is treated, scraped, and irrigated. Many gynecologists curet before plastic operations to prevent outpouring of infectious uterine material over the fresh wound surface. Almost all fear infection from the uterine cavity after hysterectomy; the cervix is therefore iodized or cauterized. Just now there is also an increasing tendency to remove the uterus in attempts to cure disease in distant regions.

My belief is that the endometrium has wonderful recuperative powers. Infection persists in it probably a shorter time than in almost any other tissue. Infection is likely if the uterus has been packed, also in complications at the cervix, such as senile obstruction, carcinoma of the cervix, or fibroids presenting at the external os. Otherwise the endometrium remains clean. It is normally uninfected and is wonderfully capable of throwing off infection. The rule of afebrile recovery after labor, when uninfluenced by vaginal examination, speaks for this.

I have now made a large number of examinations of the endometrium after hysterectomy for various causes. In smears, in cultures from the surface, and cultures of the entire endometrium ground bacteria are not often present; when found they are scarce and scattered.

It is doubtful whether chronic infection of the uterine fundus, in the presence of free cervical drainage, is responsible for systemic disturbances except in most rare instances; as a center for local infection I believe it may well be almost disregarded. Whether the same holds true of the cervix is still open to question.

CLINIC OF DR. N. SPROAT HEANEY

Presbyterian Hospital

V-SHAPED HYSTERECTOMY FOR DYSMENORRHEA AND LEUKORRHEA

Summary: A patient with membranous dysmenorrhea and associated leukorrhea; pathology of membranous dysmenorrhea; treatment by conservative procedures of no avail; relief to be obtained only when the occurrence of the menstrual periods is prevented; ovariectomy and hysterectomy objectionable because of the production of artificial climacterium; indications for **V**-shaped excision of the uterus; technic of the operation.

February 20, 1917.

The patient I wish to present to you this morning is a married woman, twenty-five years old, who comes to us for relief from dysmenorrhea and leukorrhea. She has been married eight years and has never become pregnant. She began to menstruate at fourteen. The periods are regular, every twenty-eight days, lasting for five days, and are very profuse. The patient has pain beginning one hour after the onset of menstruation and lasting the entire period. The severity of the pain is such that the patient is confined to bed always for two whole days, and has to use opiates to obtain relief, and cannot work for one week out of each four. The first menstrual period at fourteen was painless. Since that time each menstrual period has been painful and the pains increase as time goes on. The pain at the menstrual period is paroxysmal and colicky in character, and is accompanied by the discharge of pieces of membrane from the uterus. She was operated upon by someone else three years ago, at which time the cervix was dilated, the uterus cureted, and an operation performed for retroflexion of the uterus. She obtained some relief for two or three periods, and then the pain became as bad as before. The leukorrhea has been persistent for an equal length of time. It is profuse and requires the constant wearing of a napkin. The onset was gradual and did not begin with an acute history of infection. The patient at no time has had any acute abdominal symptoms associated with fever.

How do we interpret this dysmenorrhea? The persistence of the pain and the discharge of the membrane leads us to the diagnosis of membranous dysmenorrhea. She was comparatively relieved for a short time three years ago after the operation. This can be attributed to the dilated condition of the cervix. However, this was but transitory, and as soon as the cervix returned to its former size the dysmenorrhea was as bad as ever. We are dealing with a very stubborn affection, and one where we have no hope of relief by conservative procedures. During the course of the month the exudate forms in the endometrium, and at the onset of the menstrual period the endometrium loosens and becomes separated from the uterus, and then the uterus has to give birth to this membrane the same as in pregnancy. The passage of the membrane is what produces the severe pain. No medication has yet been found which gives relief.

What operative procedures are open to us? Dilatation and curetment chronically fail. The only measure which promises relief is the ablation of the menstrual period itself. Now the question arises as to how this may be done. How may we prevent this patient from menstruating and consequently remove this pain? Menstruation may be stopped by removal of the ovaries. If the ovaries are not present the patient will not menstruate, but as a result of this we produce an artificial climacterium with its attendant phenomena. The menses may be stopped by removal of the uterus, leaving the appendages behind. If we do a hysterectomy according to the usual technic, we tie off the uterine artery and its accompanying veins and thereby disturb the blood-supply of the ovaries, with the result that the ovaries undergo change, so that we can expect that within a very short time after the ordinary hysterectomy the patient will begin to enter the artificial climacterium. Is there some other means that we can employ to prevent menstruation and yet guard against the atrophic changes above mentioned? The part that produces the exudate, the part of the uterus that takes part in menstruation, is the endometrium itself. If the endometrium can be so thoroughly removed that none of it is left to undergo the peculiar changes of menstruation, then we can prevent this patient from menstruating. This may be done by a **V**-shaped excision of the uterus. In this procedure we cut out sufficient of the uterus from the fundus down to the cervix to remove all of the endometrium and then sew the two lateral flaps together. This prevents the patient from menstruating, and, in consequence, cures the patient of her dysmenorrhea. The uterine vessels are left undisturbed, as are the ovarian, and, in consequence, the ovaries remain unaffected and will last and functionate as long as they otherwise would. As a result of this operation our patient, of course, will be sterile, but she is already sterile. She has been married eight years and has never become pregnant. It is the tendency in membranous dysmenorrhea for the patient to be sterile. All the effect that this operation will have after her recovery is simply that she will fail to menstruate. Otherwise she will deport herself as normal.

Now the leukorrhea is produced by the cervix. If the membranous dysmenorrhea were the only thing to be relieved in this case we would excise only to the level of the internal os, but since we have also the leukorrhea to cure we may excise the uterus through its entire length, removing the cervical canal as well.

This same operation is the operation of choice in treating idiopathic uterine hemorrhage. It is the operation of choice in treating fibroids of the uterus, especially in younger individuals which otherwise would necessitate a hysterectomy. A young individual with a fibroid producing marked bleeding can be operated upon in this way, and either no endometrium left or many times sufficient endometrium left to produce a slight flow at the menstrual time. In this way, by avoiding a complete removal of the uterus in a young individual, we avoid disturbing the blood-supply of the ovaries and the consequent artificial climacterium.

OPERATION

We will make the usual median incision, opening up one belly of the rectus muscle, and then by dissection find the opposite belly of the rectus and open it up (Fig. 230). This will ensure a better closure and a stronger wall. As a result of the previous operation we have a considerable number of omental adhesions to our incision, which we must dispose of by folding the omentum on itself and stitching so as to prevent extensive adhesions after this operation.

Having now prepared our field, we will do our operation in the following way: First we catch each uterine horn with a bullet forceps and exert slight traction upward. Since we are here going to remove the gland-bearing part of the cervix as well as the functionating part of the uterus, we must prepare the bladder area as our next step. I grasp the peritoneum at the plica vesico-uterina with my tissue forceps, and, making it taut, I make a transverse incision the width of the uterus itself at this location, just above the plica. Then with the gauze-covered finger I gently shove the bladder downward and dislocate it from the uterus. The bladder separates very easily you see (Fig. 230, *2*). Now, with the bladder out of the way, I seize the fundus of the uterus with a third bullet forceps, and taking a large scalpel I begin at the left uterine horn and cut parallel to the side of the uterus about ½ cm. away from its border down through the body and the cervix until I now have opened up the vagina. The patient was, of course, prepared vaginally before operation. You see there is some bleeding. If at all brisk, the bleeding can be controlled by biting the uterus with bullet forceps. I now examine to see that no endometrium-bearing part has been left on this side, for if so, these endometrial islands may undergo menstrual reaction, and there being no escape, more pain may be the result than if no operation had been performed. The inspection being satisfactory, I now begin at the right horn and cut downward ½ cm. from this side of the uterus until I again cut into the vaginal vault (Fig. 230).

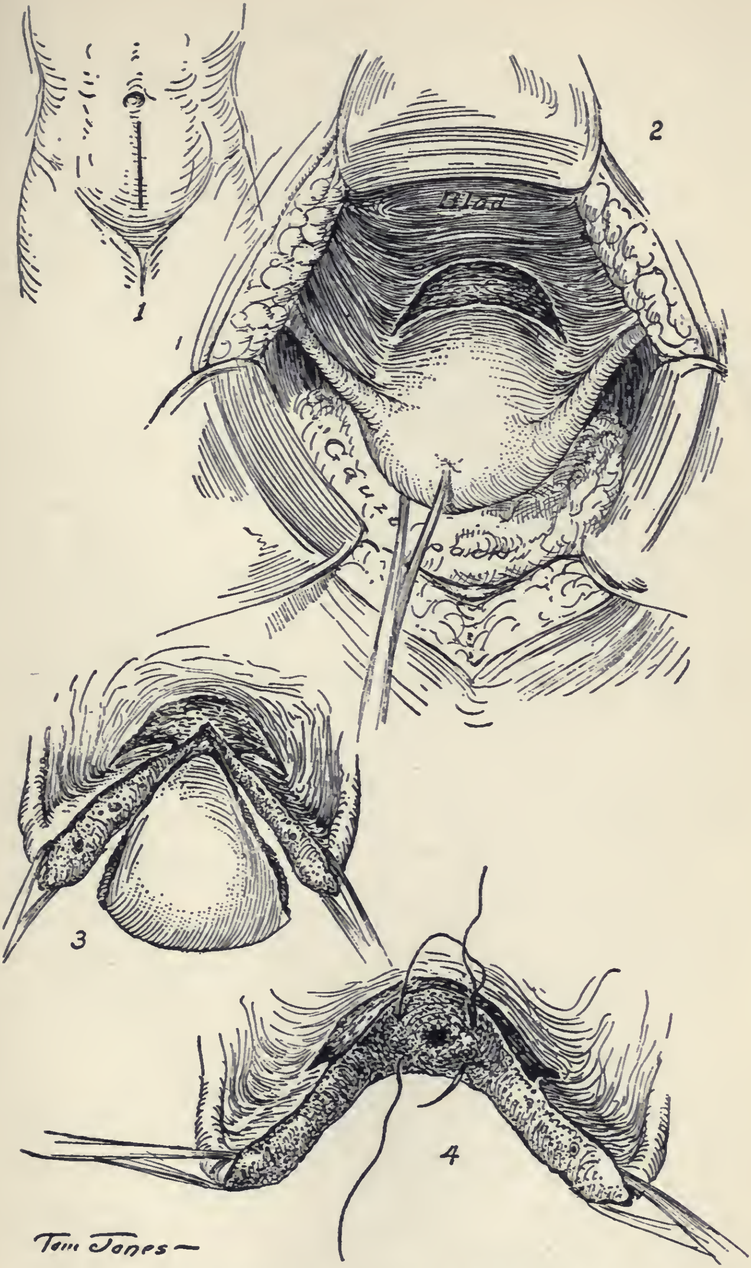

Fig. 230.—**V**-shaped hysterectomy: *1*, Line of incision; *2*, separation of bladder so as to allow excision of cervical canal when necessary; *3*, excision of the endometrium-bearing portion of uterus; *4*, continuous muscle suture.

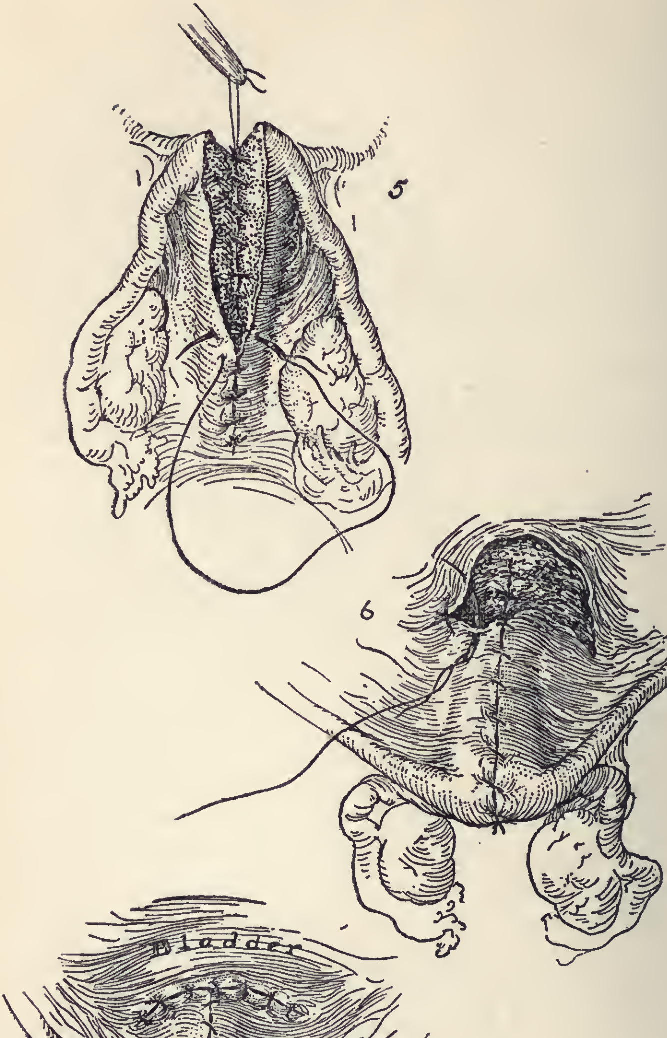

Fig. 231.

This triangular portion of the uterus which I have removed contains the endometrium and the cervical canal. I now have a small flap of uterine muscle on each side. I will draw these together in the midline by sewing the flaps together. For this I use a continuous suture of iodin catgut (Fig. 230) and, beginning at the lower end of the posterior wall, I close first of all the vaginal vault, and then go upward, coapting first the myometrium of the posterior wall up until the horns are united. I then coapt the peritoneum of the posterior surface. You will find it easier to sew the posterior surfaces together first and the anterior surfaces afterward. I now close the anterior side. You note that I close in layers of sutures first the myometrium, then the perimetrium posteriorly and anteriorly, and that I strive to make accurate coaptation (Fig. 231). *The sutures must not be drawn too tightly.* I now bring up the bladder to its previous location by sewing up the transverse incision just above the plica vesico-uterina by a continuous suture (Fig. 231). Now that our operation is completed, you see we have a small central body about the length and diameter of your thumb—a diminutive uterus without menstrual or cervical secretory function (Fig. 231). We have two normal sets of appendages, tubes, and ovaries, and since neither the uterine, communicating uterine, nor ovarian have been cut or tied their blood-supply is just as it was previous to the operation. This patient will not be able to menstruate and, therefore, will be free from the invaliding dysmenorrhea. This operation is free from all danger to the ureters also since they are well out of the field in which the work is done.

Fig. 231.—**V**-shaped hysterectomy: *5*, Peritoneal closure. The muscles having been brought together by a continuous suture, one anterior, the other posterior; *6*, bringing the bladder back to its former location by a continuous suture of the peritoneum; *7*, operation completed. View looking downward on anterior surface of uterus which is held back.

CLINIC OF DR. CHARLES A. PARKER

COOK COUNTY HOSPITAL

THE TREATMENT OF BURNS WITH SPECIAL REFERENCE TO THE PREVENTION OF DEFORMITIES

Summary: Two cases illustrating the use of adhesive plaster strips applied directly to the granulating surface after the separation of the sloughs, and the use of effective apparatus to maintain the parts in such a position during healing that the resulting cicatrix will cause no deformity or limitation of motion.

CASE I.—This patient, J. K., was admitted to the hospital on the service of Dr. Dyas on the 20th of February, 1917, suffering from a severe kerosene burn of the left side, front, and right side of the neck extending up on to both cheeks and ears (Figs. 232 and 233).

It is through the courtesy of Dr. Dyas that I present him to you in this clinic.

He has received the open-air treatment for a month and his neck and parts of his face and ears are covered with thick, foul-smelling crusts. The burn is more extensive on the front and left side of the neck and face than on the right, and he is at present able to hold his head fairly erect, although it is an effort for him to bend his head to the right away from the left shoulder. Beginning contractures are already in evidence, and if allowed to continue this patient is surely destined to develop enormous disfigurement with scar-tissue drawing the chin toward the sternum and the head toward the left shoulder. The deforming action of burns in this locality is so well known to medical men as to need no further comment.

This deforming action can be and, therefore, must be absolutely prevented. The wound is first cleaned from crusts as well as possible, best with moist dressings of plain sterile water, and

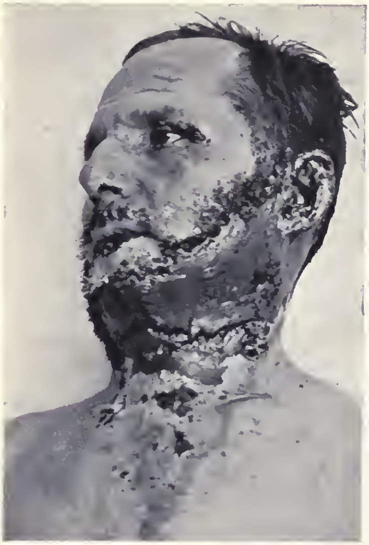

Fig. 232.—Showing burn under chin and on left side of neck and face as it appears in the open-air treatment.

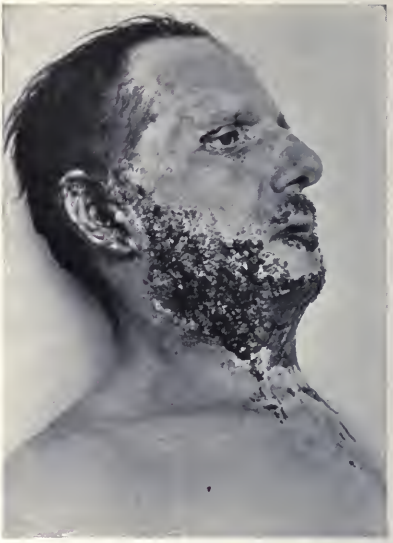

Fig. 233.—Showing burn of neck and right side of the face, open-air treatment.

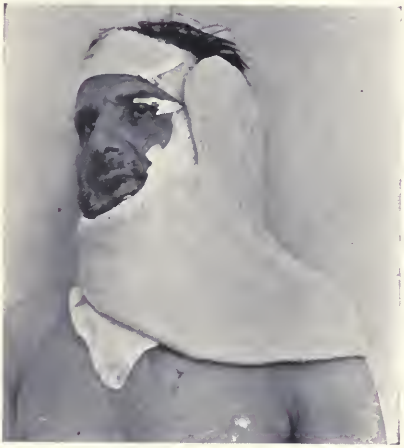

Fig. 234.—Showing plaster-of-Paris collar and cape holding head in an overcorrected position.

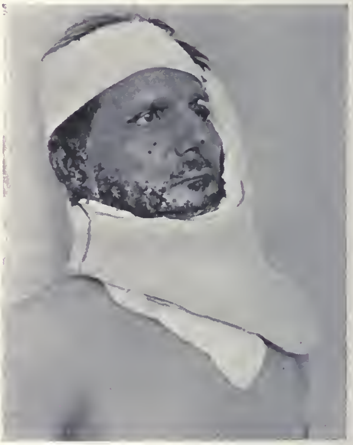

Fig. 235.—Showing the cleft in the collar where it is sprung open for removal and change of dressings.

then it is dressed with adhesive plaster strips about 1 inch wide and long enough to extend 1 or 2 inches beyond the margin of the burn on to good skin for secure attachment. Strip after strip is thus laid upon the wound until the entire surface is covered, making no provision for drainage. The ears are also covered similarly with smaller strips until every granulating area is covered (see Fig. 234 for method of applying adhesive). Over this are put several layers of gauze or pads to absorb the pus that will escape from under the strips in different parts of the field. As large a dressing is applied as is desired and held in place with a bandage. The head is now held to the right and backward so as to make the greatest possible distance between the head and the left shoulder and between the chin and the sternum, and a plaster cast is applied which encircles the neck and extends up on the left side of the head and down like a cape on to the left shoulder (Fig. 235). Before the cast has become thoroughly dry it is cut open on the right side so that it can be sprung off for daily dressings (Fig. 235). This appliance will maintain the desired position until healing is complete, and should be employed for several months thereafter or until there is no further tendency for contractures to occur. Fortunately, we now know that scar-tissue eventually ceases its tendency to contract, and if held extended a sufficient length of time complete control over it can be obtained. In the present instance contractures will at no time be allowed to occur, thus obtaining a result with which no treatment of fully developed contractures can begin to compare (Fig. 236).

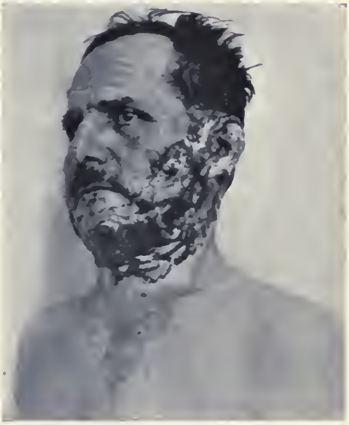

Fig. 236.—Showing burn after one week's treatment with adhesive plaster strips.

Details of Treatment.—*The Plaster-of-Paris Collar.*—A piece of stockinette is first put over the patient's head, covering also the dressings which have been applied, and fastened over his shoulders and under his arms with safety-pins, a surplus of the material extending up over the top of the head. Around this is wound sheet-wadding in several layers, covering the head, neck; and shoulder, quite regardless of the future shape of the trimmed cast. A bandage holds this wadding in place, and the plaster bandages are then put on until a thickness that one feels will be sufficient to maintain the desired position is obtained. During its application the patient's head must be held by an assistant in the overcorrected position. After the plaster is set and while it is still moist it is trimmed with a sharp knife to the desired shape. The excess of stockinette from above and from below is now folded over the outer surface of the cast and all parts sewed together, thus giving a nice finish and pleasing aspect to an apparatus that must be worn for a considerable length of time. The cut on the right, or narrow side, allows easy removal and replacement. When it is soiled from discharges it should be wiped as dry as possible and put in the sun to dry or be thickly coated with talcum powder. If properly made it will last many months. The patient learns to depend upon it and never suffers the torture entailed by accidental movements of the head or the physical exhaustion which follows from constantly guarding his injury with tense muscles.

The Dressing.—The adhesive plaster dressing is by far the best method proposed up to the present time for the treatment of the granulating area in burns. It is in no way a substitute for skin-grafting, but in all areas where grafting is impracticable or impossible it has no equal. Its action is mechanical. It flattens down granulations on convex surfaces so the epithelium has no trouble extending over them; it retains the heat and moisture, both absolutely essential to cell-life and growth, and furnishes an impermeable covering under which the epidermis can creep along and into which no granulations can extend to be torn loose at each removal, as in dressings of gauze. It does not stick to the wet surface, therefore its removal is bloodless and painless except for its adhesion to the good marginal skin. Its application with some tension to press down the granulations is equally painless. The retention of secretions is no fault, a scab does the same if it is good and efficient, and besides, the plaster, by its pressure, reduces osmosis and thus wound secretion to a minimum. To be sure, a certain amount of pus will be found under the plaster when it is removed, but it is the best fluid the infected tissues—and all burns early become infected—have to grow in, so its presence as fluid is not to be feared. The plaster should be reapplied whenever it becomes loosened at the edges. This may be twice a week or sometimes daily when there is considerable movement in the part, as about the face. The surface should never be allowed to become dry.

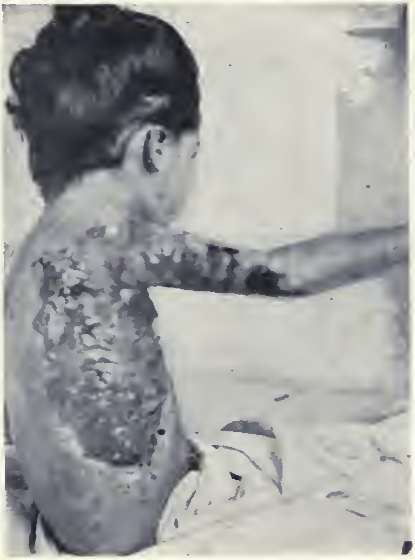

Fig. 237.—September 24, 1913, showing the extent of burn. (From the Jour. Amer. Med. Assoc., July 3, 1915, Marguerite, Children's Memorial Hospital.)

The gauze dressings should be changed every day as they become soiled. As they do not touch the wound, their removal and application is entirely without discomfort. *The wound should never be touched with solutions of any kind, antiseptic or otherwise. It is a surgical crime to apply antiseptics to these surfaces. There is no fluid so well adapted to them as the patient's own serum.*

Here are photographs of a case I treated about a year ago and which I described in the Journal of the American Medical

Association, July 3, 1915. These photographs illustrate a method of preventing deformities in burns of the chest and arm (Figs. 237 and 238). The apparatus is removable. The first indication in the treatment of a burn on the flexor surface of a joint is to hold the joint in extension during healing.

I have made the statement that "in all burns of the limbs and their connections with the body that leave the deep structures intact and ready to resume their function after the surface is healed, as long as such burns are compatible with life, healing may and should be obtained without deformity and with good function." If this is true, and I am convinced that it is, the cruel deformities of the limbs we now so frequently see must become more and more infrequent until their occurrence will be considered a distinct reproach to the one responsible for the care of the patient during the period when prevention was possible.

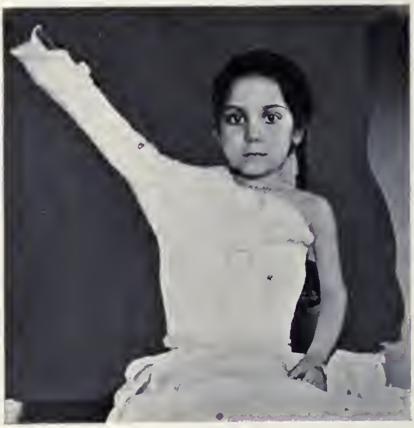

Fig. 238.—October 18, 1913, showing completed dressing with removable plaster-of-Paris splint. (From the Jour. Amer. Med. Assoc., July 3, 1915, Marguerite, Children's Memorial Hospital.)

Regarding the open-air treatment of burns:

The best thing that can be said for the open-air treatment of burns is that it is better than some very poor treatments. It was a reaction from the many vicious treatments by antiseptics, frequent changes of gauze dressings, drying powders, and other abuses. It was much more comfortable and removed the curse from the physician and put it on Dame Nature. It is very acceptable in areas where it is difficult to apply any dressing, although such areas must be of very limited extent. It is an extremely expensive dressing in the demands it makes on the body for protection. The scab is made of dried serum, bacteria, and body cells, and is only efficient as a healing agent when it has become so impervious as to keep the growing parts warm and moist. This is the normal healing under a scab, but in large areas the scab is so frequently broken that new serum and living cells must again and again be dried to maintain the necessary moisture for the growth underneath. Every drying kills more cells. Besides this, the accumulated crusts harbor saprophytes, causing decomposition, disagreeable odors, and irritating compounds that delay healing. Healing is slow, but may eventually occur with the maximum amount of scar-tissue and the greatest possible deformity. It has been found woefully wanting, and the sooner and wider this is known the better it will be for the sufferers from burns.

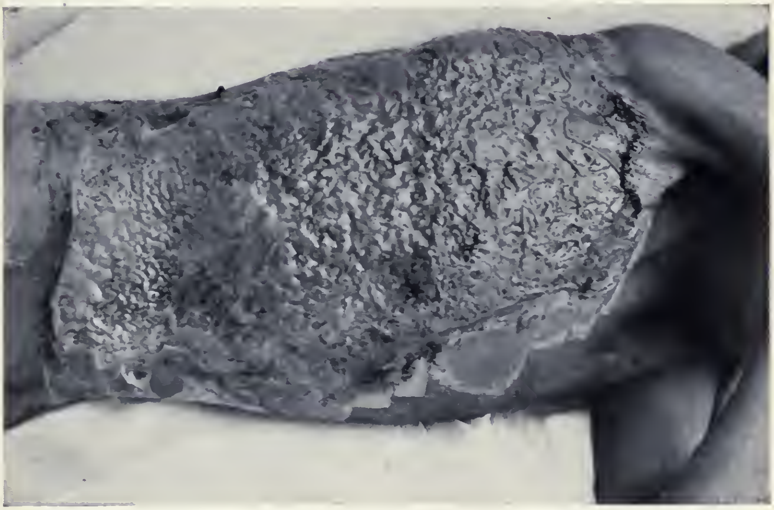

Fig. 239.—Boy, aged seven years. Extensive burn of the body after the slough has separated.

Case II.—This boy is seven years of age. Three weeks ago he was brought to the hospital with a severe burn involving the entire right side of the chest and abdomen from the axilla to a line at about the level of the great trochanter of the femur. As you see him today you note that the wound is relatively clean, the sloughs have all separated, and there is an abundance of healthy granulations (Fig. 239). We dress this case with strips of adhesive according to the plan I have just outlined (Fig. 240). The size of a burn does not materially modify the value of adhesive plaster dressing.

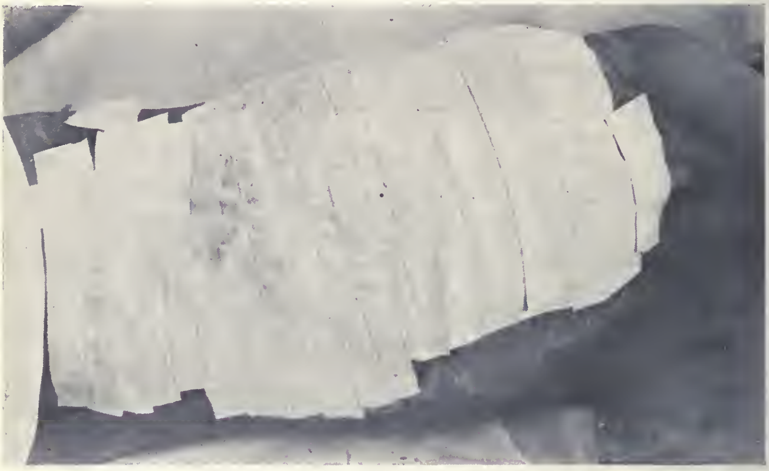

Fig. 240.—Same as Fig. 239, showing adhesive plaster strips in place.

CLINIC OF DR. KELLOGG SPEED

Cook County Hospital

MEDIASTINAL TUMOR PROBABLY ORIGINATING IN THE THYMUS GLAND: ASSOCIATED THYROID ENLARGEMENT

Summary: A patient complaining of dyspnea, dizziness, and substernal pain, with cough and rapid loss of weight; the physical signs; diagnosis of mediastinal tumor—the clinical course in this patient; the thymus gland; its origin and function; pathologic basis of thymic disturbances; tumors of the thymus.

CASE HISTORY

Two months before this man's admission to the hospital—that is, about three months ago—he fell asleep before an open window and awakened with a chill and cough. His occupation was that of a cook, his age twenty-five years, and he claimed that his health had previously been satisfactory.

His previous history was of interest inasmuch as up to the age of fifteen he had suffered from a croupy cough each winter. Some five years ago he had an infected finger with an axillary abscess from which he made an uneventful recovery. There were several diseases of childhood, dates and names forgotten, except typhoid at the age of nine. He had had no venereal infection. The family history is entirely negative, and the only untoward habit was the use of alcohol very freely in the shape of whisky, for which he sometimes substituted 50 per cent. alcohol.

A year ago he was seized with severe pain in the front of his chest, which he described as a feeling that might have been caused by an ice-pick being driven into him. His agony was supreme, so that he could not straighten up at all, and since then, on an average of once a week, these lancinating pains in the chest have returned for about a minute's duration. After the chill mentioned, which he really considered as the onset of his sickness, his cough had been almost continuous and was very productive. There were also night-sweats, and he remarked that his neck began to swell and his eyes to bulge. At first, in the midline of the neck in the thyroid region, there had been a red area and some swelling of the lower jaw and face. This rapidly subsided, but the thyroid swelling progressively enlarged. Dyspnea and dizziness appeared, and two weeks before entrance a lump appeared to the left of the sternum which soon reached the size of an egg. Heart action became slightly irregular, hoarseness appeared, and in the last few months he had lost 15 pounds, which he attributed to worry because he feared the chest pains were caused by some heart disease.

Physical Examination.—The patient is a well-developed male, coughing frequently, with resulting marked venous congestion of the face and neck. Mild exophthalmos is present, but the upper lid follows the eyeball down readily. Pupils are negative. The lower half of the front of the neck is enlarged anteriorly and laterally (Fig. 241). This enlargement is indurated, but ceases abruptly above the suprasternal notch and moves on swallowing, apparently representing the middle lobe of the thyroid. Laterally the mass in the neck does not move so freely and seems to be fused with the masses projecting from behind the sternum and beneath the left clavicle. All superficial veins in the neck are enlarged, but no pulsations, thrills, bruit, or tracheal tug are found.

The chest shows the deep-seated, fixed, egg-sized tumor to the left of the sternum in the second interspace. Over it the skin moves freely and the superficial veins are dilated, particularly over the left chest. On the right side inspiratory expansion is reduced. No apex-beat is visible. Palpation fails to locate any thrills, but there is increased tactile fremitus over the upper chest anteriorly, especially on the left side, with dulness extending 3 inches on *both* sides of the sternum *at the level of the second rib.* This dulness extends downward, symmetrically widening, until at the fifth rib level it is 5 inches in extent from the sternum. Over the right middle lobe of the lung there is bronchovesicular breathing and crepitant râles in the right midclavicular line. Over the cardiac area can be heard a soft systolic blow transmitted toward the axilla from the apex. No other physical findings of importance are present.

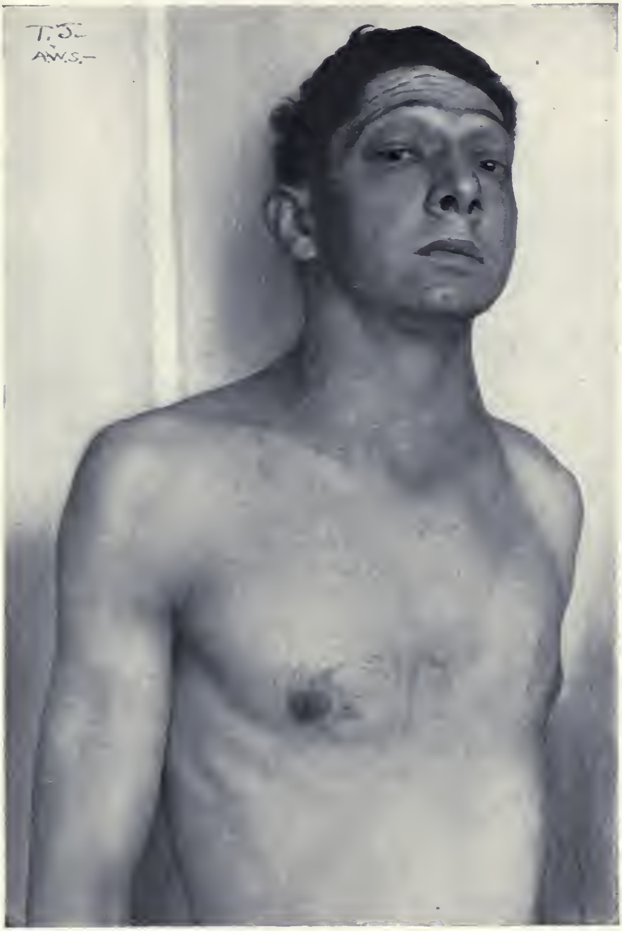

Fig. 241.—The enlargement of the base of the neck laterally and in the region of the isthmus of the thyroid is well shown. Note the engorgement of the external jugular vein and its branches.

The laboratory findings are as follows: Wassermann is negative. No tubercle bacilli are found in the sputum after several examinations. The blood showed October 10, 1916, 4,400,000 red blood corpuscles, 13,200 white cells, the differential examination of which gave 7 per cent. small mononuclear; 4 per cent. large mononuclear; 86 per cent. polymorphonuclear; 1 per cent. eosinophils; 2 per cent. transitional; 80 per cent. hemoglobin. This count gradually decreased, reaching 3,700,000 red blood-corpuscles and 14,000 white blood-corpuscles, with 75 per cent. hemoglobin early in November.

On October 29th flatness appeared in the left chest, extending downward from an inch above the inferior scapular angle. There was increased venous stasis in the neck and chest and the lateral enlargement of the chest tumor rapidly advanced, so that the left supraclavicular fossa became obliterated (probable involvement of the pleura). Nodules appeared in this mass. Chest examination gave unaltered signs. Paracentesis of the chest gave a straw-colored fluid containing many polymorphonuclear leukocytes, but no bacteria. The next day a small gland was removed from the left side of the neck, which on section showed a typical diffuse lymphosarcomatous process.

A roentgenogram (Fig. 242) showed very large rounded and lobulated shadows, extending laterally from the mediastinal shadow. These shadows are rather characteristic of sarcomatous change because they are rounded and smooth with scalloped-like edges. Carcinoma shadow differs by being stellate and more finger-like in its projections. Carcinoma we also expect to start in the hilum of the lung, so that a shadow originating in the mediastinum, as this plainly does, suggests another type of tumor. All indications pointed toward mediastinal origin.

Summary of Clinical Course.—The temperature on admission was 99.2° F., but fell to normal, rising only twice above that level, and then never over 99.6° F. Heart action was quite rapid at first, 112 per minute, but with rest this fell as low as 80, averaging 96 for the period of hospital stay. Respirations varied between 20 and 24 per minute. Iodids and mercurial rubs were instituted, and no cough sedative was necessary until three weeks after entrance, but then even large doses of codein were of little avail. Sleep was satisfactory up to sixteen days after admission. At that time he awakened in a dyspneic attack with cyanosis, and his condition failed rather rapidly thereafter. Loss of weight was particularly noticeable.

Feeling that operative interference could offer no hope, and that the rapid progress of the pressure and other untoward symptoms meant an early exitus, he was advised to go to his home in Pennsylvania. He left early in November and we were informed that he passed away two days after arrival. While we regretted the lost opportunity for postmortem examination of this interesting tumor, we felt compelled to advise him as we did.

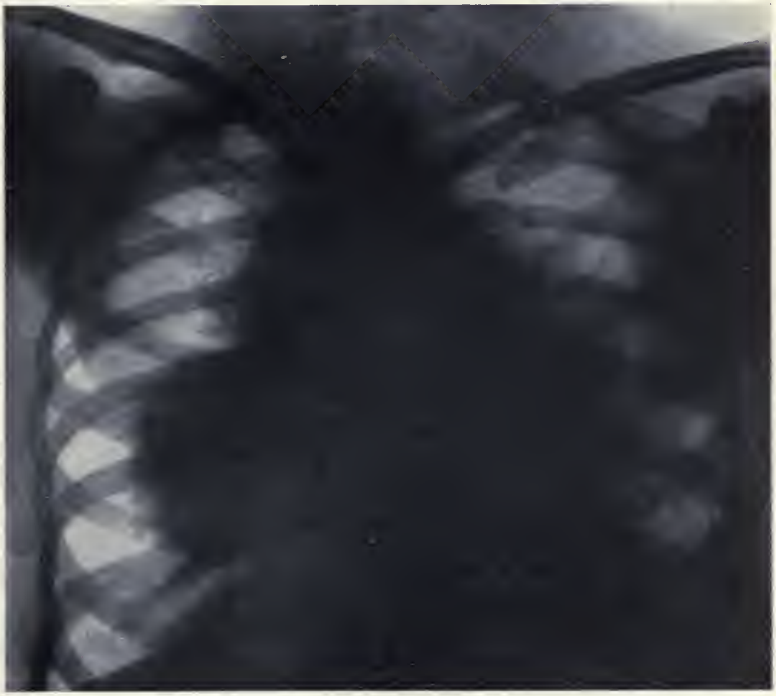

Fig. 242.—Roentgenogram of chest showing massive involvement of the mediastinum.

REMARKS

The interest in this unfortunate patient lies in the diagnosis, because surgical interference at the time when he was first seen was contra-indicated. An incomplete or hasty examination, especially without the aid of the roentgenogram, would lead the surgeon to consider the disease one of thyroid disturbance with a large neck tumor and some symptoms of hyperthyroidism. Bulging from behind the sternum from the anterior mediastinal space draws attention to the frequently forgotten thymus, and we considered that source of his trouble at once. Aberrant thyroids or parathyroids were also considered because they have both been found as tumors of this space. The close clinical connection, however, between the mediastinal tumor and the rapid recent enlargement of the thyroid rather settled us upon a diagnosis of primary sarcoma of the thymus, which may have been persistent, with secondary involvement of the thyroid, the cervical lymphatics, pleura, and both lungs. Because tumors of the thymus are unusual and easily overlooked, I would direct your attention again to this organ.

Thymus: Origin, Development, and Tumors.—Our meager knowledge of this body shows its probable origin from the third and fourth branchial clefts. At birth it is nearly at its greatest size, progressing for an average period of two years, when it is found to fill the space from the thyroid to the pericardium. It may increase in size after this age, but generally it begins to retrogress, and at puberty has disappeared into a thin network of fibrous tissue and fat. Remnants are, however, found in elderly individuals. In its two flat lobes which lie upon the trachea we find two classes of cells—epithelial elements in the reticulum and the thymic cells proper or lymphocytes (Mayo Clinics, 1912). Both the thymus and thyroid are branchiogenic, and with a closely associated blood-supply one easily believes that mutual disturbances or tumors of the two glands may be common. There is found an enlarged or persistent thymus with goiter, but not frequently. Physiologically, some observers have found that extracts of thymus accelerate the pulse-rate and lower the blood-pressure, and after thymectomy puppies become fat and lazy and they are subject to spontaneous fractures. The long bones show an interference with their calcium balance and osteoporosis with cartilage overgrowth appears. Chemical analysis of dried bones from thymectomized animals shows a great deficiency in calcium, amounting to one-half the normal content. After thymectomy also the thyroid tends to take on an increased weight.

For clinical purposes we may divide the thymic disturbances on a pathologic basis of (1) absence; (2) simple persistence; (3) hypertrophy and hyperplasia; (4) acute inflammations, resulting particularly from infectious diseases of childhood; (5) various disturbances caused by overexertion, starvation, or circulatory changes; (6) tuberculosis and syphilis, and (7) tumors.

Mayo states that in 350 autopsies the thymus was found luetic in over 3 per cent. *Dubois' abscess*, a collection of yellow drops in the cellular tissue of a normal gland and not a true abscess, is also found. Our patient gave some evidence of a persistent thymus, inasmuch as he had coughed all his adolescence in the cold weather. His diseases of childhood may have attacked the persistent thymus, caused its greater enlargement, or eventually aided irritation which set up the overgrowth. Thymic tumors are of slow growth and usually are late in manifesting themselves, so that they are confused with the thyroid or other neighboring structures. They do tend to metastasize freely, especially in the regional lymph-glands, pleuræ, lungs and kidney, spleen and pancreas, but do not attack the bones like thyroid tumors. On account of the gland structure carcinoma is rare. Sarcoma (lymphosarcoma) or mixed-cell tumors are those usually found. A few instances of cysts or lipomata of the gland are recorded.

This patient had no evidence of status thymicolymphaticus until the onset of his terminal sickness. There were no genital changes or skin pigmentation and his weakness and dizziness with the rapid pulse came on suddenly but a few weeks before exitus. The thyroid enlargement was also of sudden origin, and is, I believe, an instance of metastasis from the thymus to the thyroid coupled with some circulatory stasis. Metastases of malignant tumors to the thyroid are rare, although in status lymphaticus it is claimed that one-half of the patients show an enlarged thyroid, but the connection between persistent thymus and goiter has not yet been proved scientifically.

Let me emphasize again the necessity for careful scrutiny of all thyroid tumors of sudden origin, a thorough physical examination of the chest for dulness in the upper sternal region, a search in the history for evidence of possible thymus persistence, and a roentgenogram of the thorax. When mediastinal tumors in adults have progressed to the point of external appearance around the sternum and regional glandular involvement is at hand, operation is contra-indicated, and the decision is always backed up by the roentgen-ray examination.

CLINIC OF DR. GEORGE G. DAVIS

PRESBYTERIAN HOSPITAL

CURE FOR HALLUS VALGUS: THE INTERDIGITAL INCISION

Summary: Deformity of the foot resulting from a primary injury augmented by foci of chronic infection in other parts of the body; classical picture of hallux valgus—points of difference in this case; technic of the operative cure.

MR. T. H., of Iowa, comes to the clinic complaining of pain in the right foot and inability to walk or put weight on the foot on account of this pain.

The patient, who is thirty-nine years old, states that twenty-eight years ago a counter fell on his right foot and he was so severely injured that he could not walk for four or five months. Shortly after this he noted that the third toe was crooked—that is, it was in a flexed condition—but the foot at this time did not cause him much inconvenience. In 1903, 1907, and 1912 the patient suffered from attacks of rheumatism. During these attacks the foot in the region of the metatarsophalangeal joints became swollen and quite painful, and for the last four years walking has constantly been painful. Two years ago a callus developed on the ball of the foot. The pain is particularly acute at this point when the patient is walking or places the weight of his body on the foot. There is, however, no pain when the patient is not walking and the body weight is off the foot. These symptoms have been gradually increasing, the pain becoming greater and the deformity more marked.

Other points in the history which may have a bearing on the present condition are as follows: The patient has had attacks of tonsillitis two or three times a year for many years. He had malaria fifteen years ago when he was a soldier in the Philippine

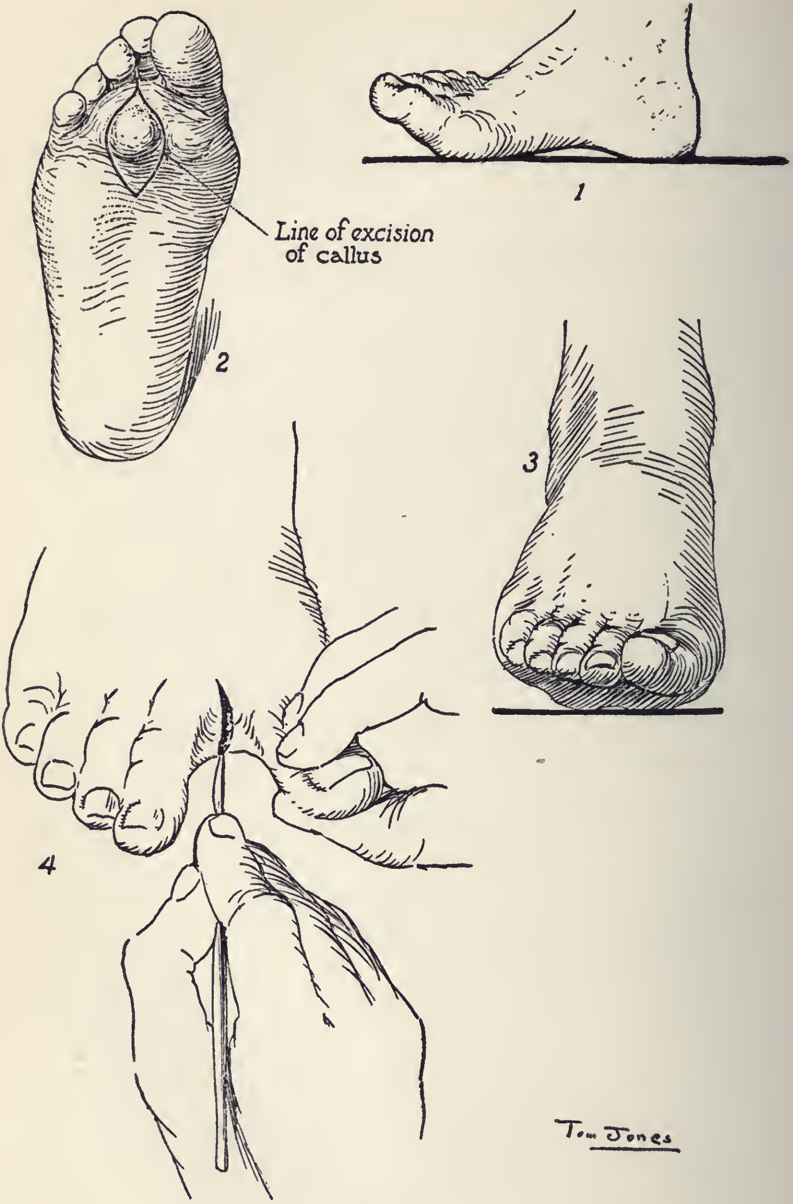

Fig. 243.

Islands, and a gonorrheal infection ten years ago. The patient denies ever having worn tight or pointed-toe shoes.

On examination of the local trouble what do we find? First we note that when the patient stands none of the toes touch the floor (Fig. 243, 1, 3). They are all hyperextended and are all free of the floor. Again, we note that they are all in the valgus position; *e. g.*, they deviate from the midline of the body. On the plantar surface, about the middle of the ball of the foot, is a callus which is $\frac{3}{4}$ inch in diameter (Fig. 243, 2). On palpation, the head of the third metatarsal bone is felt to protrude at the site of the callus, and pressure here causes exquisite tenderness. We have requested roentgen-ray examination of the foot in two views, anteroposterior and lateral. In the anteroposterior view (Fig. 244) we note that the big toe and the second, third, and fourth toes all deviate laterally. We also note that the heads of the first, second, third, and fourth metatarsal bones are markedly enlarged, especially on the median and plantar aspect. The third point to note in the plate is the hyperextended position of the first phalanges of the second, third, and fourth toes. The lateral view (Fig. 245) shows the toes in a hyperextended position, and there is a semidislocation of the first phalanx at the metatarsophalangeal joint.

We may best classify this group of symptoms under the title "hallux valgus," but it certainly may be questioned whether this entire group of symptoms is secondary to the hallux valgus, or whether, as seems more likely, the condition of the other toes is not rather the result of a process in the metatarsophalangeal joint of the second, third, and fourth toes similar to that in the metatarsophalangeal joint of the big toe. The classical picture of the advanced sequences of hallux valgus are not noted here. The toes are not huddled together or overlapping, yet we note

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Fig. 243.—*1.* Lateral view of deformity. Note the elevation of the toes which are free from the floor. *2.* Plantar view. Note the hallux valgus and the callus on the ball of foot caused by protrusion of the head of the third metatarsal bone; also the extension of incision, from the web between second and third toes, downward to encircle the callus. *3.* Frontal view. Hallux valgus and hyperextension of first phalanges causing the toes to be free from the floor. *4.* Incision being made in web between toes for approach to the head of the first and second metatarsal bones.

the characteristic type of hammer-toe as the first phalanx of the second and third toes are hyperextended and the second and third phalanges are flexed.

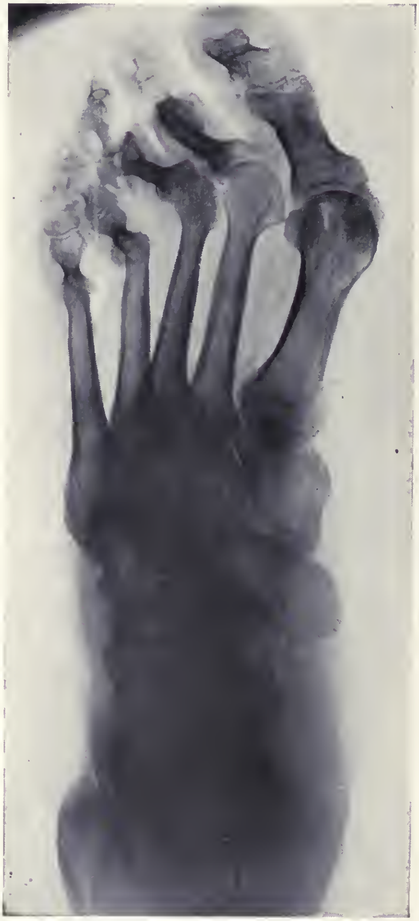

Fig. 244.—Roentgenogram showing the enlargement of the heads of the first, second, third, and fourth metatarsal bones, especially on the median and plantar aspects, causing a lateral and upward displacement of the corresponding phalanges.

The patient gives no history of ever having worn tight or pointed-toe shoes. The factors which may have played a rôle in this case are trauma and focal infection. The trauma may have played a double part, first by the injury per se, and, second, by causing a locus minoris resistentiæ for the focal infection. The two possible sources of the focal infection are the tonsils, which have been frequently inflamed, and the parts of the genito-urinary system which may have been invaded in his gonorrheal infection, most probably the prostate.

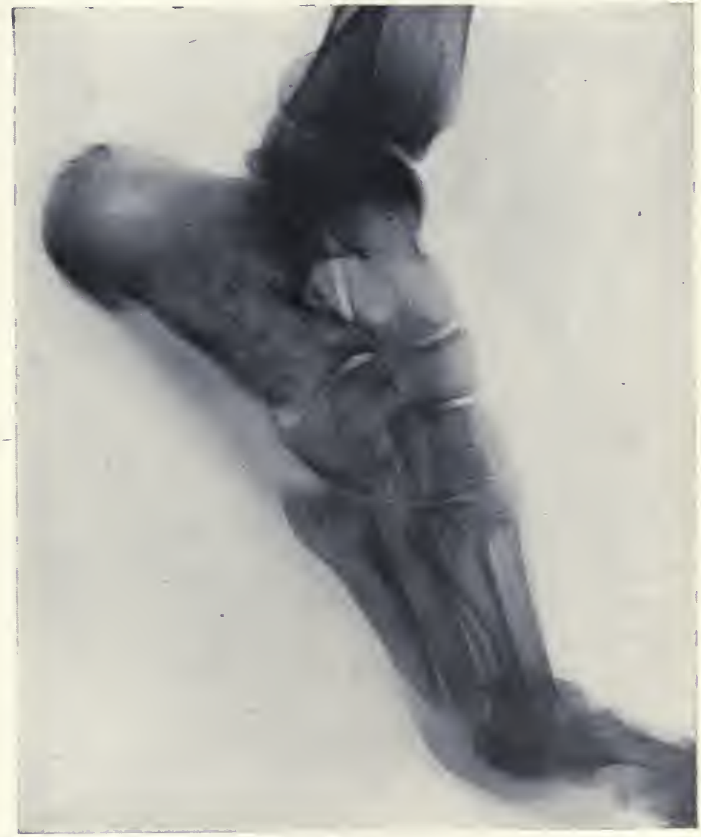

Fig. 245.—Roentgenogram showing the first phalanges in hyperextension with flexion of the second and third phalanges of the second, third, and fourth toes (hammer-toe).

The pathologic conditions here, which must be considered from the standpoint of surgical treatment, are various. There is a chronic arthritis of the metatarsophalangeal joints with an

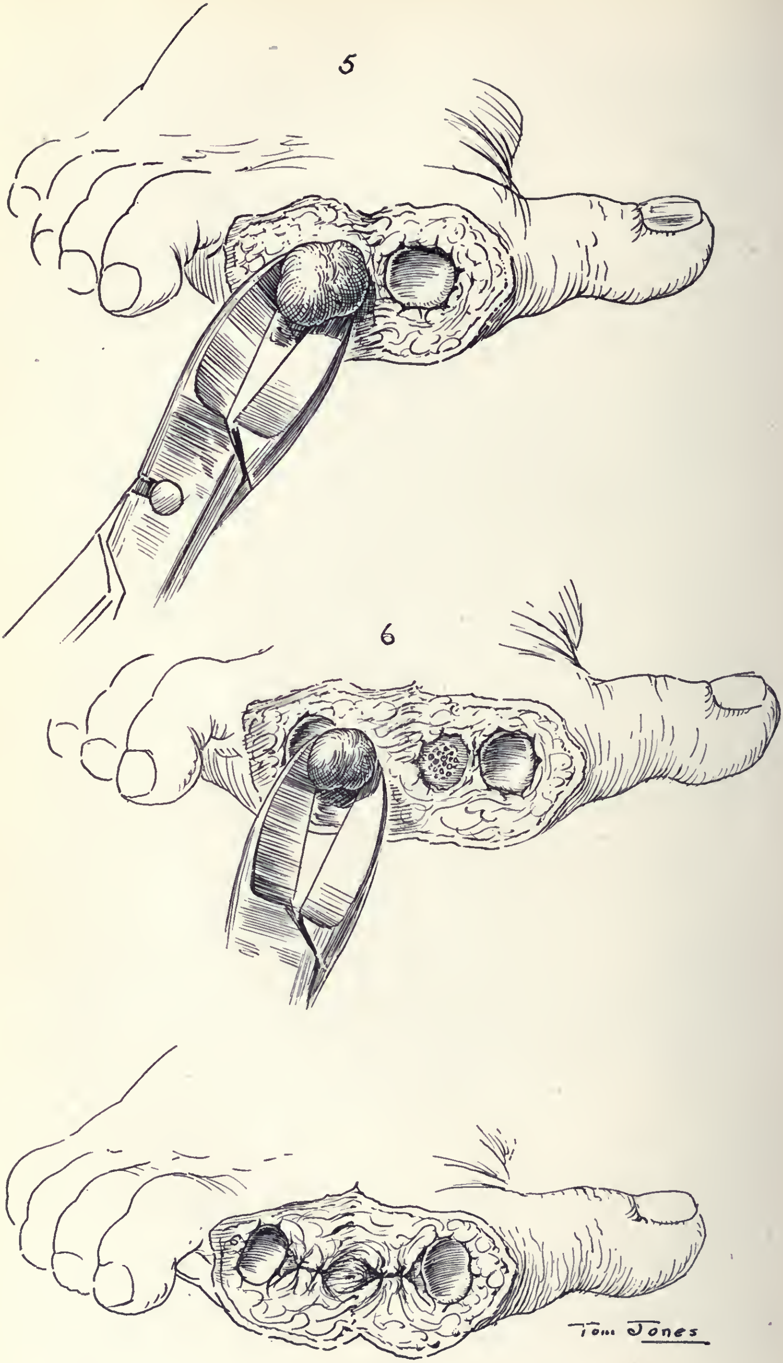

Fig. 246.

enlargement, especially of the median and plantar surfaces of the heads of the metatarsal bones. It is this enlargement probably which causes the outward and upward displacement, making a semidislocation of the first phalanx rather than the muscular traction, as is frequently stated. A contracture and shortening of the plantar fascia prolongation on either side of the phalanges assist in the hammer-toe formation. The callus on the ball of the foot, resulting from pressure on the head of the third metatarsal, must also be dealt with surgically.

The pathologic conditions here have progressed too far to be cured by such palliative measures as the wearing of correctly shaped shoes or wearing metal partitions attached to the sole of shoe, projecting between the first and second toes. Therefore we shall take surgical measures to cope with the various pathologic conditions; we shall remove the head of the metatarsal, cut the shortened plantar fascia prolongations, remove the callus, and mold the toes in their normal position.

OPERATION

First we make in the web between the first and second toes an incision (Fig. 243, 4), through which the head of the first metatarsal bone may be dislocated after the capsule of the joint has been opened (Fig. 246, 5). The enlarged part of the head of the first metatarsal is now nipped off with a bone-cutting forceps in an oblique direction, taking more off on the median aspect of the bone than on the lateral (Fig. 246, 6), that the hallux may be straightened or slightly overcorrected. The lateral

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Fig. 246.—*5.* The hallux has been dislocated medianward, exposing the smooth articular surface of the base of the first phalanx and the head of the first metatarsal, which is to be removed by bone-cutting forceps. *6.* The hallux is in forced adduction. The cut surface of the first metatarsal, the smooth surface of base of first phalanx, and, to the left, the head of the second metatarsal about to be removed by bone-cutting forceps are well shown. Under the left blade of the forceps is seen the articular surface of base of first phalanx of second toe. *7.* The articular surface of the base of the first phalanx of the big toe is seen on the right. Two pairs of stitches have been inserted, bringing capsule, fat, and connective tissue over the cut surfaces of the first and second metatarsal bones. On the left is seen the smooth articular surface of the base of the first phalanx of the second toe.

phalangeal prolongations of the plantar fascia are further divided and freed. A portion of the capsule, subcutaneous fat, and connective tissue is turned in over the cut surface of the metatarsal bone to form a new joint (Fig. 246, 7). After the first metatarsal bone has been thus cared for, the second metatarsal bone is dealt with in a similar manner through the same skin incision, which will now be closed with interrupted sutures. To approach the head of the third metatarsal bone and to deal with the callus, an incision is made in the web between the second and third toes. This incision continues on the ball of the foot to the callus, where it divides to encircle the callus (see Fig. 243, 2), which now may be excised. The head of the third metatarsal bone is removed and a portion of capsule with fat and connective tissue is again turned in over the cut surface of the third metatarsal bone.

When there is a marked hammer-toe condition with a semi-dislocation of the head of the first phalanx over the base of the second, it is necessary to resect the head of the first phalanx. The incision for this is made over the dorsum of the first interphalangeal joint. The incision between the toes and at the site of callus is closed. Silkworm tension sutures are needed to bring the edges together at the site of the removed callus.

Now that the heads of the metatarsals, which caused the hyperextension of the first phalanges, have been removed, and that the prolongations of plantar fascia, which caused flexion of the second and third phalanges, have been severed, the toes are readily brought down to their normal position or overcorrected. Dressings are applied and the foot is put in a plaster-of-Paris cast, with the toes in an overcorrected position of extreme flexion. The cast stays on until the stitches are taken out on the eighth day, when a light dorsal plaster-of-Paris splint is reapplied, holding the toes in the corrected position. This is worn until the tissues have had a chance to firmly unite in the corrected position, when the splint is removed. This will be in three or four weeks.

CLINIC OF DR. FREDERIC A. BESLEY

Cook County Hospital

REGIONAL SURGERY: DISEASES OF THE CHEST WALL, INCLUDING THE PLEURA AND BREAST

Summary: The etiology, the signs and symptoms, and the treatment of empyema illustrated by 3 cases; an acquired deformity due to paralysis of the serratus anterior muscle—the diagnosis; diaphragmatic pleurisy—differentiation from appendicitis; complications of fractured ribs—subcutaneous emphysema, pneumothorax, hemothorax; tumor at the sternoclavicular joint—probability of lues—sarcoma excluded; acute suppurative mastitis—cause—pathologic anatomy—treatment; hypertrophy of the breasts in the male associated with other evidences of disturbance of the glands of internal secretion; supernumerary mammæ; generalized carcinomatosis of the bones one year after amputation of the breast for carcinoma; chronic mastitis versus carcinoma; differential diagnosis; necessity of microscopic examination of all breast tumors; fixation of tumor to surrounding tissues one of the most important clinical signs of malignancy.

Today we shall consider the pathologic conditions which occur within the chest wall and those which involve the structures composing the chest wall. You will note as we go on with this original discussion, based on division into anatomic regions, that there is a similarity of tissues throughout the body, and with this similarity of tissues there is found a similarity in the pathologic disturbances to which they are subject. We can, therefore, classify the pathologic conditions in the chest on the same basis that we classify such conditions in all parts of the body, and so we will expect to find inflammatory processes, congenital defects, the results of trauma, and new growths. It is well to remember that these morbid processes are not peculiar to the chest wall, but may involve the structures contained in the chest cavity.

We are going to take up first those cases which are illustrative of the question of empyema. By empyema we mean, at least in these cases and in the general acceptance of the term, pus in the pleural cavity. The pleural cavity is ordinarily a closed cavity. There is no vacuum in the pleural cavity. There is a slight negative pressure, but there is no true cavity. In our classification of the pathologic entities empyema comes under the heading of inflammatury conditions. Ordinarily, empyema is due to infection of the pleura with a pyogenic organism, such as the staphylococcus, the pneumococcus, or the streptococcus, either in pure culture or mixed either with each other or with organisms which are ordinarily not pyogenic, such as the tubercle bacillus, the typhoid bacillus, and various saprophytes. So much for the bacterial classification.

Now as to the classification based on the pathogenesis: How do the organisms reach the pleura in order that they may set up this inflammatory process resulting in pus? The organisms reach the pleural cavity in one of four ways:

1. Directly, by penetrating wounds.

2. By way of the blood-stream. We frequently have the evidences of pus in the pleural cavity in the presence of general sepsis.

3. By lymphatic extension—extension from any of the surrounding structures through the lymphatics with which the pleura is richly supplied.

4. By direct extension from contiguous structures. By extension first from the lung; second, from suppurative processes in the chest wall; third, from the mediastinum; fourth, from beneath the diaphragm, through perforation of a gastric ulcer, subdiaphragmatic abscess, or a liver abscess, any of which may rupture into the pleural cavity.

As to the signs and symptoms: The symptoms are those of sepsis. We will not go into that today. We assume that you know what those symptoms are. The signs are the signs of fluid in the pleural cavity, which, briefly, are a bulging of the intercostal spaces, reduction of the respiratory movements on the affected side, dulness or flatness on percussion, coupled with a sense of resistance to the percussing fingers, that you will learn to recognize as very suggestive of the presence of fluid in the pleural cavity, and, on auscultation, absence of breath sounds as a rule. Remember there are cases in which the bronchus is wide open and in which you will get bronchial breathing over the fluid. Why do we lay stress on this? Because we do not want you to exclude the puncture needle. You should see that the needle goes through and punctures the pleura far enough to reach the exudate. That is one of the things you must remember. The last word in the diagnosis of the chest is the exploring needle, although the fluoroscope is also of inestimable value in detecting fluid, as we shall show you in a few moments.

The next question is the question of treatment. We will go into that briefly. In adults, where the pus is a pyogenic exudate resulting from either the staphylococcus, the streptococcus, or the pneumococcus, we are all agreed that long-continued drainage is required. The best way to get that continuous drainage is with rib resection rather than by inserting tubes between the ribs. For a long time we practised putting in tubes between the ribs, and we are convinced that this does not give sufficient drainage. Now as to the ribs you should resect: In our experience the majority of operators, the majority of text-books, and the majority of teachers place the incision for empyema too low. It is advised by the majority that it be made at the level of the seventh or eighth rib. In our judgment that is a rib or two too low. We think the incision should be made at the fifth or sixth rib in the midaxillary line. We believe it should be made in this line, first, because the lung is higher up at that point than at any other, and, second, it allows the patient to lie in the supine position without interfering with the drainage. The reason the high incision should be made is this: when you make a low incision, even though you are well above the dome of the diaphragm, there is a tendency for the diaphragm to curve upward and block your tube. Since we have had an opportunity to use the *x*-ray so frequently and note the movements of the diaphragm, we find that the diaphragm curves up on the drained side. A suction apparatus should be put on either with bottles or with a Bunsen pump. Anything that will maintain suction all the time in these empyema cases is desirable. The idea is to expand the lung as rapidly as possible. You know a lung that is collapsed expands during expiration and not inspiration. A suction apparatus is easily applied, but difficult to maintain because of the kinking of the tube and the entrance of air around the tube, but these difficulties can be overcome by constant care and attention. The object of all this is to get the lung to expand as rapidly as possible and to prevent the adhesion of the visceral and parietal pleura. The two layers readily become adherent, and when they do, expansion is interfered with.

Fortunately today we have 3 cases which illustrate three different types of empyema.

CASE I.—EMPYEMA (TUBERCULOUS)

There is little to show in this case, and I shall simply give you the history: This man had a stab-wound of the chest which was followed by empyema. Notice the large amount of pus that is draining from this opening. Notice that there has been a large and extensive operation of some kind done and that the wound has been packed with gauze. A piece of gauze packed into a granulating cavity or sinus is never a drain, it is a plug. If the cavity is widely open the pus will run out. If you pack in gauze the capillary action is practically nil. Notice the capillary action here. Note that the gauze is practically dry at its outer end. A gauze drain is a misnomer. It is never a gauze drain, it is a gauze plug, and should only be used following operative procedures to keep the edges of the skin apart temporarily or to prevent hemorrhage.

It is not clear from the history whether this man subsequent to his injury developed a hemothorax—that is, an accumulation of blood in the chest—or not. At any rate, as we have seen, empyema followed the injury, and this empyema is now believed to be tuberculous, for the sputum is teeming with tubercle bacilli. Whether or not the tuberculosis is a primary or a secondary affair we do not know, but the probabilities are, when we consider that so many patients have pulmonary tuberculosis, that this man already had a pulmonary focus when he sustained this injury. He received a stab-wound, which carried pyogenic infection into the pleural cavity, with the resultant production of a suppurative process. He may have developed tuberculosis in his pleural cavity secondary to the pyogenic infection, but the converse is usually true—a tuberculous infection followed by secondary pyogenic invasion. This patient's chest was drained by resecting a rib and putting in a tube. It went on draining and draining, the pleura became thicker and thicker, the lung failed to expand, and finally it was deemed advisable to do a radical operation for the purpose of obliterating that suppurating cavity. Obliteration of the cavity may be attempted

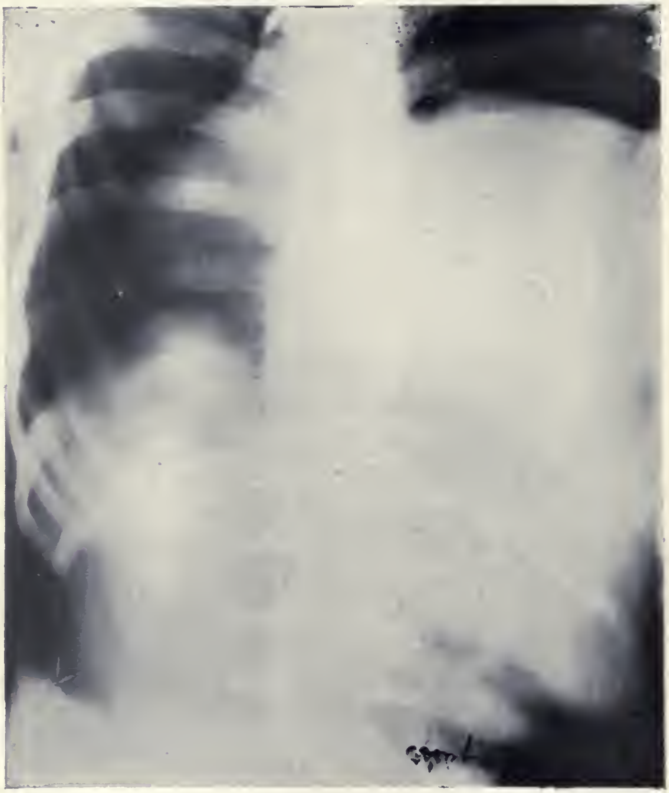

Fig. 247.—Case 1. Roentgenogram of chest: Tuberculous empyema following stab wound, associated with tuberculosis of the lung.

by any one of a number of operations. The Estlander operation, in which a portion of each rib which overlies the cavity is resected, allowing the parietal pleura to fall in against the visceral pleura, is not very satisfactory as a rule. The Schede operation, in which one removes not only the ribs but also the underlying thickened parietal pleura, gives somewhat better results. Third, and more extensive, is the Fowler operation; this involves the removal of the covering of the lung or visceral pleura, and is, therefore, best known as the *decortication* operation. One of those operations, we do not know which, was done here. This man is pale and thin, with all the appearances of a chronic sepsis. The result of the extensive operation in this case is not good.

CASE II.—EMPYEMA FOLLOWING HEMOPNEUMOTHORAX

This man has a history similar to the one we have just discussed, but without the tuberculous complication. This man received a stab-wound in the chest about thirteen weeks ago, which resulted in a large collection of blood in the chest cavity. This large collection of blood became secondarily infected with pyogenic organisms. Yesterday it was drained. Drainage was accomplished by means of a tube, which we believe is the only satisfactory method of draining empyemas in an adult. In children, in the pneumococcus infections, the aspiration method is probably better, aspirating either at intervals or continuously if you like. The objection to tubal drainage is the same objection that prevails in draining a cold abscess. It is not possible to put a tube into the pleural cavity infected with pneumococci in children without producing a secondary infection with some other pyogenic organism. You are adding to the pneumococcus infection another pyogenic infection. That does not occur as frequently when you aspirate. It is well known that very frequently in these exudates in adults we fail to find the offending organisms in the fluid. That does not mean that the offending organism is not there. In dealing with organisms you must remember when you take a culture or a smear from the fluid you are only taking a smear and culture from the exudate, you are not taking it from pathologic tissue itself, which is the pleura. The underlying pathologic entity is the thickened and inflamed pleura. Frequently one can get active cultures and positive smears from that tissue when they cannot be obtained from the exudate.

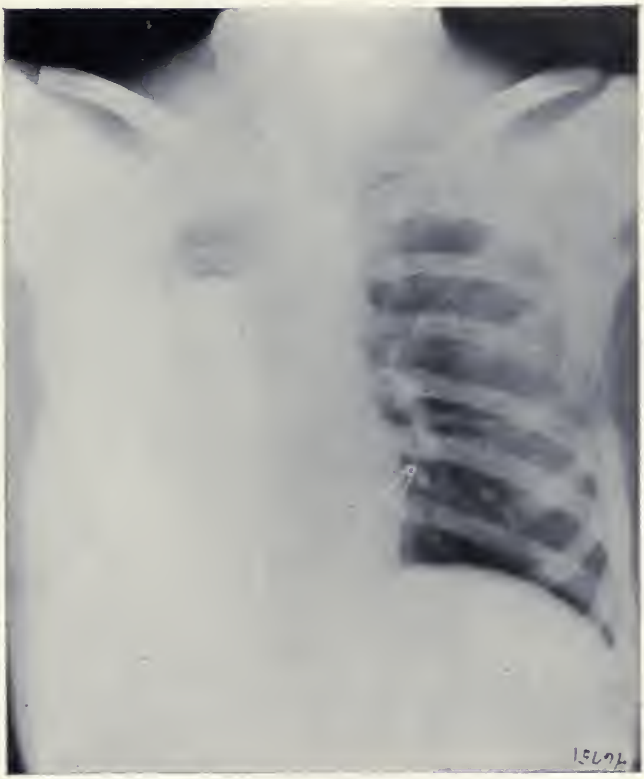

Fig. 248.—Case 2. Roentgenogram showing extensive hemothorax following stab wound of chest. Note the sharp line indicating the fluid level at the fourth rib posteriorly.

In this man is represented the type of exudate which is found in the traumatic empyemas. There is first hemorrhage into the pleural cavity; the blood-clot becomes infected and a chocolate-colored, purulent exudate results. This man was drained yesterday and looks much better. He does not look as sick as the other man.

CASE III.—EMPYEMA (AMEBIC) SECONDARY TO A LIVER ABSCESS

This case is of a type which we cannot often show you. This man came into the hospital a number of weeks ago with amebic dysentery. He developed, from the amebic dysentery, a liver abscess. Since that is not our subject today we will not go into it. This man had an amebic abscess in his liver and a large collection of pus beneath the diaphragm, which was drained, and as a result of that collection of pus beneath the diaphragm he has an empyema on the right side due to the extension of the infection from beneath the diaphragm.

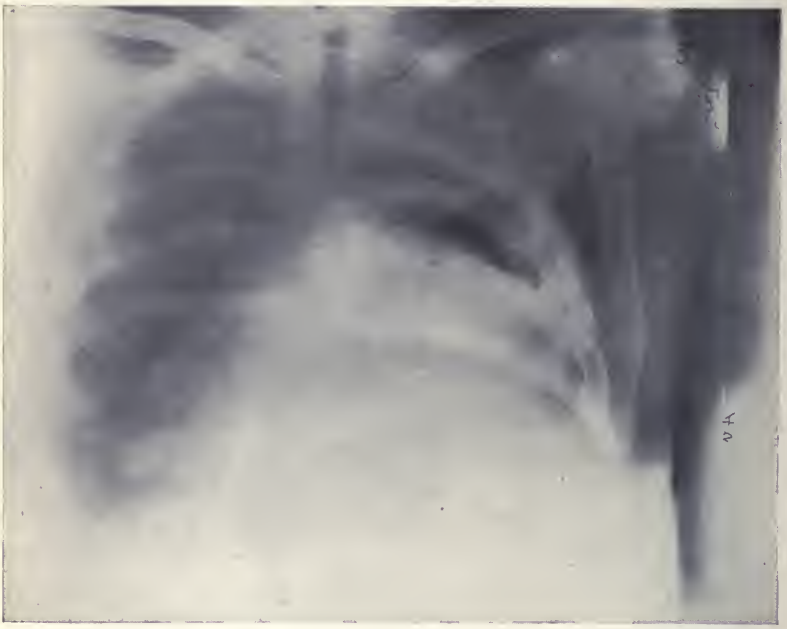

Fig. 249.—Case 3. Amebic abscess of the liver with secondary pleural involvement.

Just to go back for a moment: Here are 3 cases in which empyema occurred in three different ways. In the first it was purely traumatic. The second one is due to secondary infection of a true hematoma in the chest. The third is the result of a liver abscess. In this man we believe the process extended through the diaphragm. Such extension from the abdominal cavity through the diaphragm into the pleural cavity may happen in one of two ways—either by rupture directly through the diaphragm or by way of the lymphatics; that is, infection may reach the pleural cavity from the abdomen without producing gross injury to the diaphragm. This man has been drained and is getting along very well. He will get well. Will the man with the tuberculosis and secondary infection get well? Probably not. We have an *x*-ray picture of the chest in Case I taken before it was opened (Fig. 247). Let me call your attention to this. We believe from the density of the shadow that there is some blood in this exudate. We do not believe the shadow would be as dense as it is without the presence of blood. A hemothorax shadow is more dense than the shadow from pus alone. Notice the diaphragm is pushed distinctly down. The heart, however, is not pushed over as widely as it ordinarily is.

This is the plate of the second case (Fig. 248). You can see that one side is full and one side empty. Here is the plate from the last case (Fig. 249). You can see here the collection of fluid on the right side.

CASE IV.—ATROPHY OF THE SERRATUS ANTERIOR (LONG THORACIC PARALYSIS)

This case presents a condition that is rather rare. Malformations of the chest are either congenital or acquired. Here is one of the acquired types. Notice this scapula. This girl cannot raise her right arm beyond a 90° angle. As soon as she attempts to raise it any higher you notice the right scapula is moved upward, but the arm remains stationary. We are dealing here with a paralysis of the muscles supplied by the long thoracic nerve. The paralysis is not due to an injury, as you sometimes see following a dissection of the axilla, but is due to an inflammatory process which has destroyed the function of the long thoracic nerve, or the "nerve of Bell," as it is sometimes called, which supplies the serratus anterior muscle. The serratus anterior is attached to the side of the chest and to the vertebral border of the scapula. Why should destruction of the function of the long thoracic nerve prevent this patient from raising her arm above her head? The reason is this: The deltoid raises the arm to the horizontal position. The scapula does not move as long as the arm goes to 90°. After that the serratus magnus pulls the scapula forward, and so, in unison with the deltoid, elevates the arm to the vertical position. This is an unusual case and illustrates one pathologic entity—an acquired deformity of a structure about the chest.

CASE V.—DIAPHRAGMATIC PLEURISY

This woman came to the hospital the night before last, sent in as a case of appendicitis. She gave a history of a rather sudden onset of abdominal pain. There was no vomiting and no nausea. She complained of pain first in the epigastrium and then a little lower down. She was rigid. She was rigid when we saw her yesterday and she is a little rigid yet, but now has no tenderness. The special point of tenderness on admission was a little high for an appendix. She had no cough, but it was very difficult for her to breathe. She had, as I remember, only a little temperature upon entrance to the hospital. Her leukocyte count, low at first, afterward came up to over 20,000 and her temperature ranged between 100° and 103.4° F.

This patient was gone over very carefully that night without further results, but the next morning a distinct pleural friction-rub was heard. This girl has a diaphragmatic pleurisy. The intern thinks that now there is a small amount of fluid in the chest. In adults it is necessary to have 14 to 16 ounces of fluid in the pleural cavity before you can demonstrate it by physical examination. With an aspirating needle, of course, the presence of much smaller quantities of fluid can be detected. This girl is an illustration of a good diagnosis made by the intern under difficult circumstances. It is extremely difficult at times to differentiate between an inflammation of the pleura covering the diaphragm in contradistinction to an abdominal lesion. The pain in diaphragmatic pleurisy is referred to the abdomen, and you get rigid muscles, which is one of the most characteristic signs of involvement of the peritoneum. Therefore one should be extremely cautious about drawing a positive conclusion where there is any suggestion of a friction-rub in the chest cavity. The chest should always be gone over before one decides to operate.

CASE VI.—FRACTURE OF THE RIBS

This man fell a distance of 10 or 11 feet and came into the hospital with a fracture of the rib. How does a fracture of the rib concern us? Chiefly because of the complications. An analogous condition is fracture of the skull. It is not the fracture of the bones that concerns us so much as it is the injury to the underlying structures. What may happen in a fracture of the rib? A fractured rib may puncture the lung. The lung is sometimes caught, so that escape of air from the lung produces an emphysema of the subcutaneous tissues. The question is, Is that emphysema serious? We have seen it in cases where it was very serious. We have seen emphysema of the subcutaneous tissues, following a fractured rib, involving the whole body, where it was so extensive as finally to involve the circulation in the neck by pressure. What can be done? The treatment is simple. Under local anesthetic cut down upon the fractured ribs and resect the fractured portions. You may say it is rather difficult to locate the exact point of fracture. Yes, without the use of the *x*-ray it is, but with the *x*-ray you can locate most fractures. You can go down and resect the rib that is holding the lung against the chest wall and allowing the escape of air. If you cannot do that, make a resection of the rib anywhere, open the pleura, and allow the lung to collapse. That stops the emphysema. It may sound strange to you that emphysema becomes a source of danger, but there are cases in which it does occur. Further than this, fractured ribs are not very serious. They are only serious if they injure the lung. They may puncture the lung and produce pneumothorax or hemorrhage, both of which are relatively uncommon, and neither of which is especially dangerous unless secondary infection occurs. The results of such an accident have been amply illustrated by our first 3 cases. Fractured ribs themselves are not very serious and usually heal very kindly.

CASE VII.—GUMMA OR SARCOMA AT THE STERNOCLAVICULAR JOINT

Here is a little girl whose mother gives a history of having had several miscarriages and of having had one baby born dead at term. This little girl comes in complaining of nothing but a swelling at the sternoclavicular junction on the right side.

As to the physical characteristics of this swelling: It is hard, firm and bony, does not fluctuate, is uniform in outline, smooth, and the skin moves over it. It does not move on the bony structures beneath. It involves the sternoclavicular joint on the right side. It has been our experience that swellings at the sternoclavicular junction are practically always leutic, either congenital or acquired. It is so nearly always a leutic involvement rather than a sarcoma that we are never justified in making any other diagnosis until we have had several negative Wassermanns, and even then you should put the patient on antisyphilitic treatment. This Wassermann has been made twice, and the laboratory man refuses to state whether or not it is positive. If it were a sarcoma, would it be getting smaller? No. We have gone over the literature regarding tumors of the clavicle, and found several resections recorded with ultimate cures. Coley, of New York, wrote an article on the subject a few years ago. We are convinced that many of these so-called sarcomata are syphilitic. We do not believe that a sarcoma of the clavicle ever gets well no matter what you do, whether you excise it, or whether you treat it with Coley serum or *x*-ray, or what not. This tumor mass is growing smaller under antiluetic treatment.

CASE VIII.—ACUTE SUPPURATIVE MASTITIS

We discussed in connection with our empyema cases the inflammatory conditions that involve the inside of the chest. Inflammatory conditions may involve the breast. This girl has a baby sixteen months old which she has just weaned.

It is her first baby. Inflammations of the breast are more apt to occur with first babies than in the subsequent pregnancies. Inflammations of the breast are most apt to occur during the first two months and usually during the first month. Inflammations of the breast may be of three kinds. First, the general heading of acute and chronic. Under the acute come the suppurative and non-suppurative. Many of the acute inflammations of the breast do not go on to suppuration. When an infection of the breast occurs it occurs around the nipple through an abrasion, through some little eczematous patch, or through some little break in the skin. In addition, infection may be brought by the blood-stream, by the lymphatics, or it my come from the underlying rib. An abscess of the breast may occur in one of three places: it may occur in the skin over the breast, it may occur in the breast tissue itself, or it may occur underneath the breast. We believe that an infection from the surface travels in one of two ways: it either goes directly into the duct and travels along the duct itself, or it goes into the lymphatics and travels in the lymphatic spaces outside of the duct. Billroth taught that a good many years ago. We believe, however, that in a large majority of the cases it is the deep structures that are infected by way of the lymphatics. Bacteria enter the lymphatic spaces and travel along the lymphatics outside of the ducts and produce disturbances outside of the duct. Fortunately, some of these do not go on to suppuration. They may be caused by any pyogenic organism.

The best plan of treatment, in our judgment, is early incision. We were very much surprised to hear one of the best obstetricians in Chicago say he allowed an acute mastitis to go on until all the structures had broken down in such a way that he could drain one pocket. In my judgment the incision should be made just as soon as we feel certain there is a collection of pus. We believe the breasts recover more rapidly than they would recover were the operation delayed. There is one danger in this, a danger that we have placed a great deal of stress on, and that is, the danger of incising into a streptococcic process. Then you open up new areas to an infection which does not readily become localized and is very prone to spread diffusely through the tissues and even produce septicemia. We are going to operate this case now.

This is one of the operations we can do under nitrous oxid. The only principles of surgery involved in opening an abscess of the breast are those involved in opening every abscess, and the principal one is, make the incision long enough. The incision should be made just as long as the cavity, and, in the breast. radiating from the nipple parallel to the milk ducts. We will put in a little strip of packing covered with plain vaselin so as to stop the hemorrhage. This will be removed in a few hours.

CASE IX.—PHYSIOLOGIC HYPERTROPHY OF BREAST (INTERNAL SECRETION SYNDROME)

Some of you have seen this boy before, but we want to show him again, because it is one of the rarest conditions we have ever seen. The patient is fourteen years old and precociously developed. He has a marked hypertrophy of the breasts. Ordinarily the male breast contains only a little glandular tissue. Most of the male breast is connective tissue. There is more connective tissue relatively in the male breast before puberty than in the female breast, but at puberty the female breast develops very rapidly. Here is a boy whose breast tissue has developed markedly. That, however, is not the rare side of this case. He has evidences of a marked disturbance in the other internal secretions. He did have rather a rapid pulse. He has a little enlargement of the thyroid gland and he has a distinct exophthalmos. He has a distinct Von Graefe. This is evidence of a disturbance in an internal secretion independent of the enlargement of the mammary gland (Figs. 250, 251). We have never seen a male with a hypertrophy of the breasts coming on at puberty such as this boy shows, associated with such definite evidence of imperfection in the other glands of internal secretion. We have taken *x*-ray pictures of this boy's head for the purpose of finding out the condition of the sella turcica, so as to see if the pituitary gland is enlarged. So far as we are able to make out with any of the stereoscopic pictures—

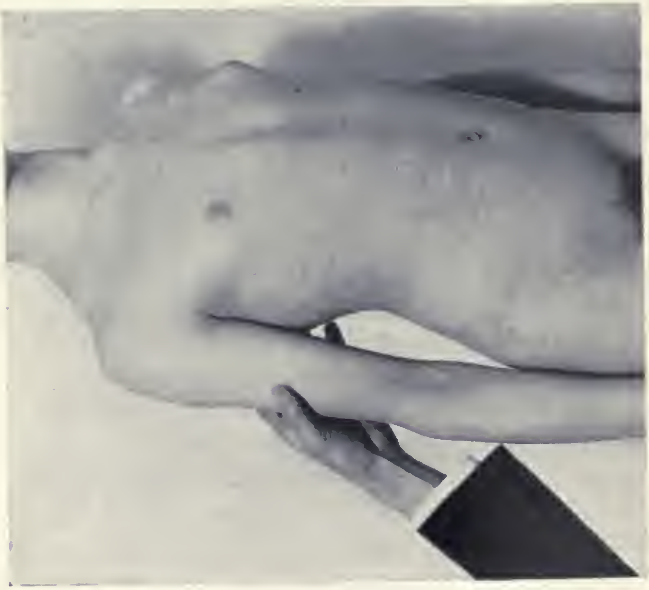

Fig. 250.

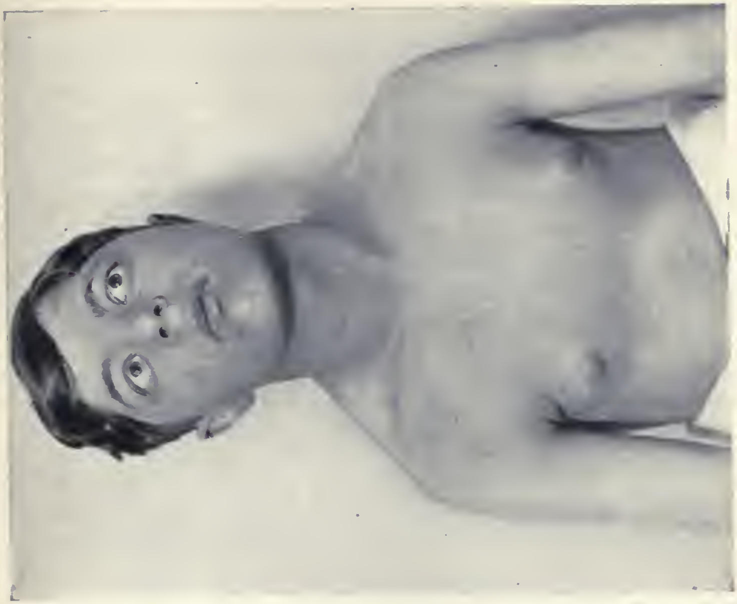

Fig. 251.

Figs. 250, 251.—Case 9. Physiologic hypertrophy of the breast with enlargement of the thyroid gland and exophthalmos.

and those are the only pictures that are of any value in determining whether the sella turcica is enlarged or not—we concluded that the sella turcica was definite in its outline and was not especially large, so we believe this boy has no disturbance in his pituitary gland. The other glands are not inflamed and he has no involvement of the axillary lymphatics. He has no evidence of an inflammatory condition anywhere. His blood count is practically normal. He did have a little tremor at one time and he did have a little rapidity of the pulse, but they have disappeared.

CASE X.—BURN OF THE BREAST

This patient illustrates a traumatic condition we see rather commonly, namely, a burn of the breast. Burns of the breast occur rather frequently. This is a burn of the second degree, a burn which involves more than the superficial structures. There is a little sloughing. The thing of interest to us is what will get this burn well in the shortest possible time. In our judgment the open-air treatment will. This breast should have no covering. Its traumatized surface should be exposed to the air and nothing applied in the way of medication.

CASE XI.—SUPERNUMERARY MAMMÆ

This patient illustrates a congenital anomaly. We have here supernumerary breasts, one in each axilla, separate and distinct (Fig. 252). These are not fatty masses. They enlarge with the breasts during menstruation and pregnancy. They follow the exact course that a normal breast follows. Aberrant breasts may occur, and by "aberrant breasts" we mean breasts that occur over the shoulder, low down on the abdomen, on the back, and even on the arm.

CASE XII.—CARCINOMA OF BREAST WITH METASTASES TO SPINE, CLAVICLE, FEMUR, AND PELVIS

This woman had a tumor of the breast and she had a wide dissection made last October. She now has a pathologic fracture of the clavicle on the left side. She has a paralysis of both arms that came on rather suddenly. She has a Babinski on one side. She has a little sensation in the left hand. There is a rather firm, hard, nodular mass in the other breast at the present time. This paralysis of both arms came on rather suddenly one morning as she was getting out of bed. She fell and immediately lost the use of both arms. She can move her feet, but they are weak. Of course, the condition is quite clear: this woman had a carcinoma of the breast which was removed, and she now has the most extensive metastatic carcinomatosis of the bones that we have ever seen. She has a fracture in this clavicle at the site of a secondary growth. She has an involvement of the head of the humerus, of the glenoid cavity and scapula, and of the pelvic bones. She also has a carcinoma of the spine in the cervical region, which has led to spontaneous fracture with resultant paralysis. The very wide and extensive carcinomatosis of the bones everywhere is shown clearly by the x-ray plates.

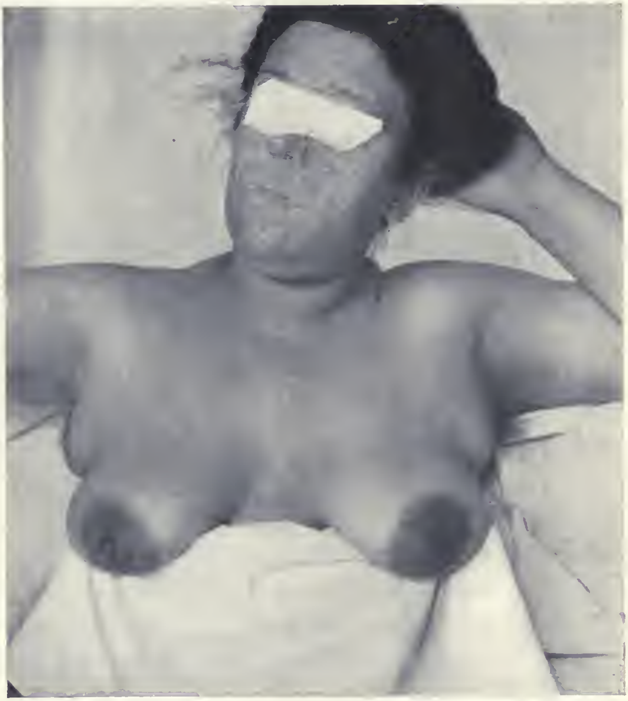

Fig. 252.—Case 11. Supernumerary mammæ.

CASE XIII.—CHRONIC MASTITIS (PRECANCEROUS)

This patient comes from the ward with a diagnosis of "chronic mastitis." We have not seen her before. We discussed with you briefly acute mastitis. This is going to be, as it seems to me, a pronounced demonstration of the fallacy of the common use of the term "chronic mastitis." That chronic mastitis exists we would, of course, not attempt to refute. Chronic mastitis is a common condition that has been described by various men—Reclus, Schimmelbusch, Bloodgood, Wilson, and others. There is a list of names applied to the condition known as chronic mastitis that would fill a double column of our text-books. The later literature has gradually decreased the number until now the general term, as we see it most commonly used, is "mastitis cystica chronica," or chronic cystic mastitis. Analyzed, what does that mean? That merely means an increase in the fibrous tissue in the breast; a chronic increase and dilatation of some of the ducts. In our discussion of the pathology of chronic cystic mastitis not a word should be said about the proliferation of the epithelial cells except when it comes to a fine discrimination between chronic inflammations and cancer. It is not wise to discuss the epithelial cells. The only question that is involved concerning the epithelial cells in the gland is this: Is that epithelial cell still within its normal confines or has it invaded the surrounding structures? We are familiar with McCarthy's classification. The great question as to whether a chronic mastitis predisposes to carcinoma is the problem that at the present time is unsettled. We do not believe that pathologists or clinicians are clear enough in their minds as to the etiologic factors that enter into the causation of cancer to say that a chronic inflammation predisposes to cancer. Now do not misunderstand that statement. We do not wish to be recorded as saying that an inflammation does not predispose to carcinoma. We merely wish to say that we do not know, and that we do not believe anyone knows, about a positive relationship. Let us take what is perhaps as nearly analogous to carcinoma as anything we know, namely, tuberculosis. Before we had a clear knowledge of the pathology of tuberculosis, what a chaotic condition existed! Many conditions that were not tuberculosis were called tuberculosis, and conditions that were tuberculosis were called something else. We do not believe that we can say because a scar exists in the cervix of the uterus that that is a precancerous scar or a precancerous stage. If that is a true statement, then every patient who has borne a child has a precancerous state in her cervix. We do not believe that every patient who has chronic mastitis has, therefore, a precancerous state. In other words, the term "precancerous" is not a good term to use. It leads to error in diagnosis and to error in clinical judgment, and, therefore, to error in surgical judgment. A thing is a cancer or it is not a cancer. The fact that we see hundreds of patients with chronic mastitis who never develop cancer is pretty good argument that chronic mastitis is not an important element in the etiology of cancer.

Here is a patient who is sent up to us as a case of chronic mastitis that is not cancerous, but precancerous. She has been shown in two other clinics as a case of precancerous mastitis. This is a good case for demonstration. There is no retraction of the nipple and there is no difference in the size of the breasts. She has a little bloody discharge from the left nipple which has existed over a period of two years. There is no diffuse induration in the breast. In chronic mastitis the thickening is usually diffuse. In this lower inside quadrant there is a distinct tumor about the size of an English walnut, firm, nodular, and adherent to the skin. One of the means of differentiating between a diffuse inflammatory induration and a distinct tumor is to stand behind the patient with the hands over the patient's shoulders and feel the mass against the ribs. It is said in some good textbooks that that is one of the strongest diagnostic signs for differentiating between true new growths and inflammatory processes; that in a new growth you will still feel the tumor between the breast and the chest wall. If the tumor still exists as a tumor mass, it is a new growth, but if the mass that you felt when picking it up with your fingers seems to disappear when you palpate with the flat hand against the ribs, it is inflammatory. Now this mass does not disappear. Do not let me be misunderstood. We place little confidence in this sign. Our experience has taught us that we cannot tell by any means that we know of the difference between a benign and malignant growth of the breast at all times. We are not sufficiently acute in our discriminating ability to differentiate between a benign and a malignant growth in the breast in every case. It is our conviction, borne out by considerable experience that we have had, that no one can. In the last month we have been deceived three times with three different cases. In two of the cases in which the pre-operative diagnosis was malignancy the pathologist reported a benign tumor. In the third case, regarded clinically as benign, the tumor was found to be malignant. What does that mean? It means that no clinician and no pathologist has any right to talk about a precancerous state or to make any positive statement as to whether a tumor in the breast is malignant or non-malignant in the absence of laboratory analysis. We believe that any tumor in the breast is potentially malignant until the microscope proves that it is not. There is only one safe procedure, and that is, to give your patient an anesthetic and have her understand that the anesthetic is given for the purpose of removing all that it is found necessary to remove. We have had patients completely refuse operation after waking up on the table while the frozen section was being run through. Every patient that comes to you who has a tumor of the breast, regardless of her age and regardless of the length of time that the tumor has existed, should be told that the tumor is potentially malignant, that you will refuse to take the responsibility until she submits to one procedure; that is, a general anesthetic, removal of the mass in toto, an immediate frozen section for the purpose of diagnosis, and, if malignant, then a radical operation. If it is not malignant, a few sutures close the wound and the patient goes home the next day happy. That is the only way you are going to be able to save any considerable number of patients who come to you with a tumor of the breast.

Just a word about the proportion of malignant and non-malignant tumors of the breast: Virchow and Billroth maintained that 75 to 90 per cent. of all tumors of the breast were malignant. We are coming to believe now that not 50 per cent. are malignant. Why have statistics changed? Because of the education of the laymen through the lay press. Women are consulting physicians about all tumors of the breast. Formerly a woman never consulted a physician about a tumor of the breast until it grew to an enormous size. They never consulted a physician about a small mass in the breast. At the present time Bloodgood, Rodman, and others in their statistics are placing the benign tumors at 50 to 60 per cent. Whenever a patient consults you with a tumor of the breast, make it clear to her that you are not willing to assume the responsibility of a diagnosis without a frozen section. No man, no matter what his surgical experience has been, is justified in making a diagnosis without a microscopic section, and—let us add this—even a good pathologist may be mistaken.

To come back to this woman: She has a definite tumor mass that has been growing for two years, with a little bloody fluid coming out from the nipple. The growth can be felt as a very firm, nodular mass. *The skin does not move over that particular part of the breast.* The growth is not firmly fixed to the chest, *but it does not move readily.* It is very characteristic, it seems to us, in this essential. It is not a chronic mastitis. It is not a precancerous state. *It is a well-developed carcinoma of the breast.* Should this case be watched? Certainly not. Should she have any treatment for a chronic mastitis? This patient has not chronic mastitis. If one ever could make a diagnosis of carcinoma clinically it would be in this case. An immediate operation should be advised and made radically if the frozen section confirms the clinical diagnosis.

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